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ACUTE SINUSITIS IN CHILDREN ASSOCIATED WITH ORBITAL COMPLICATIONS. THE CONSERVATIVE TREATMENT. REPORT OF TEN CASES.

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With the prevalence of acute upper respiratory infections in children, the occurrence of acute sinusitis as an accompaniment is exceedingly common. It is during the influenza or grippe epidemics that the sinusitis plays an important role. Oftentimes the primary infection is soon overshadowed and recedes quickly into the background with the onset of symptoms resulting from invasion of the nasal accessory sinuses.

We are not concerned here in the broad sense of the word with these cases in which the infection, remaining limited and well confined within the affected sinus, gives rise to no evidence of extension to any of the adjacent structures intimately connected with the sinus. The sinusitis, although comprising a prominent part of the clinical picture, running a course more or less parallel in both time and intensity with the general infection, goes on to spontaneous resolution with subsidence of the influenza attack.

Nor are we concerned in this communication with cases, unlike those above mentioned, in which, for definite and well established anatomical reasons, the drainage from the affected

sinus is defective or inadequate, and as a result of which the infection becomes so well riveted in the tissues as to ultimately lead to chronicity.

It is the sole purpose of this paper to consider from the anatomical, pathological, clinical and therapeutic aspects only those cases of acute sinusitis in children which are accompanied by signs and symptoms suggestive of possible extension of the infection from the involved sinuses to the orbital cavity.

Until recent years many cases with such orbital complications were captioned "idiopathic," owing to our failure to trace the relationship between sinus infection and invasion of the orbit therefrom. It is not very many years ago when the entire subject of the nasal accessory sinuses in young children was one of conjecture and speculation and on the whole shrouded in a veil of mystery. With such rapid progress in other fields of rhinology this particular branch was made conspicuous by the lack of interest shown by rhinologists in general and the lack of development of our knowledge of the subject. A close analysis of the factors which were responsible for impeding its progress soon discloses the apparent causes.

To begin with, the unfamiliarity with the signs and symptoms emanating from sinus disease and our failure to properly interpret them when present contributed to a large extent in keeping this particular phase more or less obscured. For example, the presence of a profuse nasal discharge was readily recognized by many as having its origin somewhere in the nasal sinuses. However, if the discharge was only scanty or of an intermittent nature and especially if present to so slight a degree as to go undetected, the possibility of sinus infection in such a case was at once dismissed as highly improbable. And we know full well that very often it is in such cases of sinus infection in which the products of suppuration fail to find free egress into the nasal chambers that complications are more apt to supervene.

Then again, one must not fail to recognize the great difficulties attendant upon examination in these patients in whom the nasal chambers are so small, lending themselves most unsuitably to careful and detailed study. Supplementing this fact by the lack of co-operation occasioned by the inability

of these little patients to intelligently and adequately describe their subjective complaints, we see at once why the attention and interest of the public and consequently that of the rhinologist required a much longer time before it became focused in the proper direction. It was not, therefore, until sufficient impetus was given by the rapid and growing need for the elucidation of its many problems that the necessary interest and effort were directed to these fields of investigation.

What was once an insurmountable obstacle in the correlation of sinus disease and orbital infection has been overcome to a great extent by the advancement in recent years in our knowledge of the anatomy and development of the nasal accessory sinuses in children and particularly the better conception of the pathological processes involved in disease of these cavities. The latter has permitted a more definite clinical picture to be evolved in conditions of this kind. Thus are we now better enabled to link up upon a sound anatomical and pathological basis primary disease of the sinuses with secondary involvement of the orbit.

Then, with the aid of Roentgenology, which has become indispensable in sinus diagnosis, we are able to arrive at an accurate diagnosis in the majority of cases, even where the symptoms are vague and the other aids at our command are only sufficient to awaken our suspicions as to where the trouble has originated.

Finally, I wish to call attention to the use of the nasopharyngoscope as an aid in overcoming some of the former difficulties encountered in obtaining a satisfactory view of the various structures in the child's nose. A great deal of valuable information concerning the condition of the sinuses can quickly be obtained with this instrument. A little experience with it soon enables one to become familiar with the views obtained by posterior rhinoscopy. It is especially suited to learn the condition of the middle turbinal, the middle meatus, the olfactory fissure and the various structures in the nasopharynx. Watson Williams,[1] after many years of experience with this instrument, expresses the opinion that it is an invaluable aid in the diagnosis of obscure sinus infection. I have found this to be the case, and especially when employed in children.

It is a well established clinical fact and this is borne out by an intensive search through the literature that the max-

illary and sphenoidal sinuses in children never give rise to orbital complications of the type under discussion. The same may be safely said for the frontal sinus. However, there are several cases recorded in the literature in which the orbital complication was apparently due to an extension from the frontal sinus. In these cases I am inclined to believe that the frontal sinus, if a distinct and appreciable one, could be demonstrated at this age, was secondarily implicated from primary involvement of the anterior ethmoid cells. Where the details of the operation were carefully recorded, extensive disease of the ethmoid cells was simultaneously found. We have but to call attention to a well established embryological fact, *e. g.*, that the frontal sinus is an offshoot from one of the anterior ethmoid cells and is more or less rudimentary in children of the age with which this communication deals. Therefore, in the discussion of the anatomy and development of the sinuses I shall touch only upon that of the ethmoid labyrinth.

We are greatly indebted to the European investigators for our early knowledge of the anatomy of the nasal accessory sinuses. Schnitzler, Zukerkandl, Kuhnt, Killian, Onodi, Hajek and others made valuable contributions as a result of their exhaustive studies of the sinuses from their great wealth of postmortem material. Onodi,[2] particularly, deserves the credit for the preparation of a most magnificent and illuminating work in which he presented a minute and detailed description of a series of specimens that he dissected and studied. Beginning with the early fetus he traced through infancy, childhood and adolescense the growth and development of the nasal accessory sinuses. The work is characterized by the usual care and thoroughness which marked all the contributions of this pioneer. In America should be mentioned the names of Coffin, Sluder, Davis, Dean, Mosher, Skillern and many others who have contributed considerably to our knowledge of the anatomy of the paranasal sinuses in children. Special mention should be made of that most excellent work of Schaeffer,[3] published about a decade ago, which deals with the embryology, development and anatomy of the paranasal sinuses.

Development: The ethmoid cells are primarily extensions of the nasal mucous membrane from the middle, superior

and first supreme nasal meatuses. Fig. 1 shows the well defined meatuses in the fetus from which these indentations take place.

As early as the fourth month of fetal life the initial ethmoidal outpouchings are in evidence. By the seventh month the evaginations have taken shape in the form of hollow, tubular-like, blindly ending sacs, with ostia in communication with the points of initial outgrowth.

It has usually been stated that no ethmoid cells are present at birth. However, we know that not only is this not the case, but it has been shown definitely that they are present

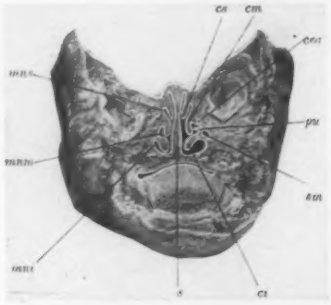

Fig. 1. Coronal section through the head of a fetus 6½ mos., showing nasal fossa with septum(s), the lower(ci), middle(cm), and upper(cs) concha, the lower(mni), middle(mnm), and upper(mns), meatuses, the maxillary antrum(sm), and an anterior ethmoid cell(cea). From Onodi.

in the term fetus. It has also been demonstrated that in the latter, as early as the sixth or seventh month, they are similar to those in the adult in respect to arrangement, number and distribution. Fig. 2 shows the early formation of ethmoid cells in the new born infant.

The lateral masses of the ethmoid bone and its appendages are primitively solid structures. Soon after birth the lateral masses become honeycombed by the development of the ethmoid cells. The growth of these cells seems to depend upon the osteoclastic activity of the periosteum under the mucous membrane. For this reason we have one cell growing more rapidly than another; one crowding out the other and sometimes finding its way around it. It can readily be understood, therefore, that in later life this distortion and

irregularity of development may lead to interference with the drainage from the cells so affected. An ostium in some instances may be located in the roof of a cell instead of at the most dependent point. This anatomical fact may help to explain the causation of the development of closed empyemas in the ethmoid labyrinth to which Hajek[4] has called attention.

There is early a division, topographically, of the ethmoid field into two groups: *1.* cellulae ethmoidales anterior, *2.* cellulae ethmoidales posterior or, better still, according to Hajek, cells of the middle meatus and cells of the superior meatus. The anterior group develops from points caudal to

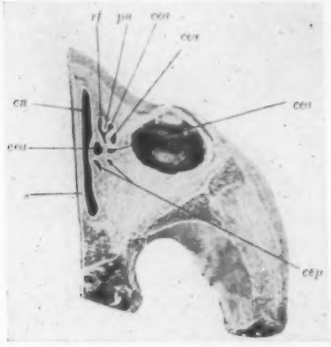

Fig. 2. Horizontal section through head of newborn infant showing frontal recess (rf), uncinate(pu), anterior(cea) and posterior ethmoid cells(cep), nasal cavity(cn), nasal septum(s). Onodi.

the attached border of the middle concha, and the posterior group from points cephalic to the attached border of the middle concha. Fig. 3 shows the suggestion of this early division.

The ostia of the anterior group of cells are located at the upper part of the uncinate groove and that of the bulla, and those for the posterior group in the posterior part of the superior meatus. This leads to the clinical observation that disease of the anterior group of cells is evidenced by the presence of pus in the middle meatus or under the middle turbinal, and disease of the posterior group by pus in the superior meatus or over the middle turbinal.

It seems that after the second year the ethmoid cells develop fairly rapidly. Their growth is not only limited in extent to the normal ethmoid capsule but they are very often displaced and appear to burrow their way into anomalous locations. These deviations from the normal are numerous but those that concern us here are of two types: *1.* those that invade the frontal bone, the so-called frontoethmoidal group, and *2.* those that extend into the orbital process of the maxilla, the so-called infraorbital group. These two types have their origin in the anterior ethmoid cells. There is another anomalous invasion which is observed less frequently

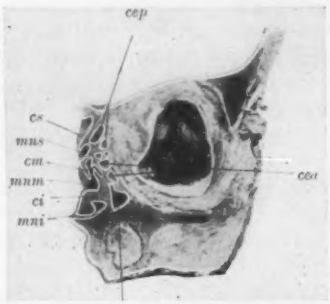

Fig. 3. Coronal section through the head of a child one month old, the lateral wall of the nasal fossa, maxillary antrum, anterior ethmoid cell(cea), posterior ethmoid cell(cep), lower(mni), middle(mnm), superior (mns) meatuses, lower(ci), middle(cm), upper(cs) concha. From Onodi.

and originates in the posterior ethmoids, the so-called ethmomaxillary cells found in the body of the maxilla.

These variations from the normal receive their importance from the fact that, as the circumference of the bony orbit is encroached upon by the cells of the ethmoid it increases thereby the possibility of an infection spreading from the latter to the former. This becomes more apparent when one considers the fact that the inner wall of the ethmoid labyrinth is formed by the os planum or lamina papyracea, a structure extremely thin and delicate. It is connected by sutures to the lacrimal, frontal, nasal, superior maxilla, palate and sphenoid bones. At two definite points of the sutural tessellations are the anterior and posterior ethmoid foramina.

In the anterior half of the orbit the lamina limits the anterior ethmoid cells and in the posterior half it corresponds

to the posterior group. Defects are not common in the os planum, in the form of congenital dehiscences, so that at times the ethmoid cells are separated from the orbit by a thin fibrous membrane. This membrane is made up of the mucous membrane of the ethmoid cells and the periosteal lining of the orbital cavity. An anatomical feature of great importance is the ease with which the periorbita or orbital periosteum is detached from the smooth underlying surface of the os planum. It can therefore be raised very readily by sanguineous or pathological effusions resulting from disease of the ethmoid cells.[5]

In the adult this plate is osseous in nature and firm in character and does not yield to pressure under ordinary circumstances. In the child, however, ossification is not complete and, owing to its cancellous structure, it is more or less pliable and somewhat elastic. It is for this reason that any distension in the ethmoid cells may readily displace the os planum from its normal position.

A brief discussion of the anatomy of the orbit and the arrangement of its contents at this point is necessary in order to understand some of the signs and symptoms that comprise the clinical picture presented in orbital affections secondary to ethmoid disease.

The orbit is a conical shaped cavity surrounded by bone on all sides except at its base. It contains the eyeball, ocular muscles, orbital fat, blood vessels and nerves. About one-fifth of the orbital space is occupied by the eyeball. The ocular muscles surround the globe and the large arteries and veins running parallel to the muscles are distributed to the interior of the eyeball and the structures surrounding it. Interspersed between all these structures and acting as their support is the orbital fat, which is very abundant and richly supplied with lymph spaces.

Pressure outside the orbit may produce an encroachment upon the orbital space. This results in increased orbital tension. Owing to the fact that the eyeball is incompressible because of its firm fibrous capsule (Tenon), and this applies more or less to the muscles, tendons, arteries and nerves, the increase in the orbital pressure seems to be exerted mainly against the orbital fat. The latter supports the superior and

inferior ophthalmic veins, the main channels for the return circulation from the orbital structures. It is because of this anatomical relationship of the large veins embedded as they are in orbital fat and unprotected from the effects of increased intraorbital tension, that they are more vulnerable to this pressure than are the other orbital structures. Owing to the thinness of the vein walls the latter become compressed very readily. This results in retardation of the circulation and development of edema of the orbital contents. This edema is therefore purely passive or obstructive in nature and does not result from active inflammation of the orbital tissues. I wish to call attention to this distinction because it is of the utmost importance in the discussion of the operative indications, upon which I shall dwell subsequently.

I have traced briefly the development of the ethmoid labyrinth and touched only upon those features that may have actual bearing on the pathological processes in ethmoid disease. I have, in consequence, omitted many phases which are of great interest to us as rhinologists, but which do not influence the disease *per se*.

From this brief discussion we conclude that the ethmoid cells are present at birth and develop fairly rapidly in early childhood. Their arrangement is identical with that in adult life. They are potentially a most suitable soil for infections and rank foremost in frequency and importance in sinus disease in children. Owing to their anatomical distribution, the ethmoid cells are brought into close proximity with the orbital contents and are not infrequently the etiological factor or the primary focus in suppurative diseases of the orbita.

Pathology: Up to a decade ago very little was written of the pathological studies in diseases of the paranasal sinuses in children. As I have stated before, the apparent reasons for this deficiency in our knowledge resulted from the difficulty in recognizing these conditions and consequently the meagerness of the material obtained for pathological study. A great deal of work had been done in adult pathology and so most men were content in applying their findings in the adult to those in the child.

In general, it may be said that the two are similar in many respects. The microscopical changes that take place in the

acute inflammatory processes are essentially alike in both the child and the adult. There are, however, a number of factors present in the child unlike those in the adult, which serve to influence and distinguish the two. We know that the ravages of disease in general are far more effectual in young tissues that are in the process of development. Having previously established the fact that the ethmoid cells are present and of sufficient size and capacity in the young child, we see at once why these cavities are more vulnerable to infection in the early years of life than in the adult. Contrary to the prevalent belief, children are far more susceptible to sinus disease than has heretofore been recognized. Coakley[6] supported the view many years ago that sinus disease was as common in children as in adults. Mosher[7] claimed that owing to very frequent precociousness of development of the sinuses in children it subjected them to as frequent and intense involvement as adults. Maver[8] wrote 30 years ago that the rarity of sinusitis in children was due to our failure to recognize and diagnose the malady. Dean[9] also called attention to the fact that sinusitis in children under 2 years of age was much more common than generally believed and he likewise attributed the apparent rarity to the lack of our diagnostic ability.

Furthermore, I wish to call attention to the fact that ethmoid disease in children occurs far more often than we have hitherto believed. The idea has always been prevalent that because the maxillary sinus reached an appreciable size in early childhood, it was a natural consequence to attribute to its involvement the nasal discharges encountered in so many children. However, it seems from clinical experience and investigations carried on in more recent years that the ethmoid cells share perhaps even more frequently than do the antra in sinus disease in children. With the aid of the X-ray this has been repeatedly demonstrated. I am sure that many rhinologists will bear me out when I say that very often in children suffering with what appears to be advanced sinus infection, antrum lavage is repeatedly negative despite the presence of a copious nasal discharge. Employing suction in these children, one obtains an abundance of mucopus. Where is this coming from? In these young patients we know the frontals are small and do not reach above the glabella before 5 years of age. The sphenoids, we know, are also of no

significance at this time. Most of the pus obtained, therefore, must have its source in the ethmoid cells. Skillern[10] believed all cases of sinusitis in children under 5 years of age were ethmoidal. Mitchell[11] made a careful study of 145 cases of sinusitis in children and found the ethmoids involved in all of them. Davis,[12] studying the incidence of sinusitis in children, concluded that the ethmoidal cells were the ones most frequently involved. Theisen[13] recorded 31 cases of ethmoiditis in children, in whom six developed orbital complications. So that we are justified, at least, in concluding that ethmoid infection in children should be counted as a very frequent occurrence and recognized as such.

It was Wood[14] who called our attention to another important anatomical difference between the adult and the child; namely, that the bone in children was softer and contained a greater amount of diploe. He believed it was owing to this that infection of the sinuses in children spread so rapidly to the deeper tissues. It is also due to this fact that the bony walls constituting the ethmoid cells yield to pressure within the cells and permit of their distention beyond the normal limits without actual necrosis of these shell-like structures.

Owing to the fact that the mucous membrane of the ethmoid cells is essentially similar to that in the other sinuses it follows, therefore, that the pathological changes observed are identical. One outstanding difference should be mentioned. The mucous membrane of the ethmoid cells is more delicate and of a finer texture. Its stroma is very loosely packed. This has a twofold pathological significance; first, it permits of inflammatory processes to spread widely and rapidly to the deeper layers of the mucosa, which functions as the periosteum; secondly, inflammations very readily produce intensive edematous infiltration. This is one of the outstanding characteristics of ethmoidal inflammation in children and gives rise to a sequence of pathological phenomena which are responsible for the production of the ocular manifestations. Owing to this rapidly developing edema of the ethmoidal mucous membranes the ostia of the involved ethmoid cells become closed, interfering thereby with the egress of the products of inflammation from the cells. The latter consequently become overfilled and distended. This dilatation of the labyrinth displaces the lamina so that it encroaches upon

the orbital space. This in turn raises the intraorbital tension. As I have previously designated, this increased intraorbital pressure causes compression of the venous channels of the orbit with the production of edema of the lids and chemosis of the conjunctiva. It is interesting to note that the displacement necessary to raise the intraorbital tension need not be extreme.

At the beginning, therefore, the edema follows directly upon the mechanical interference with the return circulation occasioned by the dilatation of the labyrinth. The latter takes place without actual necrosis of the lamina. The dilatation is further enhanced when the lamina is defective and is made up in part of a fibrous membrane. In the latter instance, an inflammatory exudate which, although purely labyrinthine, may very easily displace the periorbita. This displacement is oftentimes extensive, with the result that the eyeball itself may become dislodged laterally and downward and appear to be exophthalmosed. It should be remembered that even with such marked displacement, the active inflammatory reaction may still be confined to the ethmoid. For this reason when these cases are operated externally at this stage no free exudate or pus is demonstrable in the orbit itself. Furthermore, these cases resolve spontaneously with the establishment of drainage from the ethmoid cells, with means other than surgical intervention. This spontaneous recovery could hardly be expected if the orbital tissues themselves were diseased and involved to the extent that the signs and symptoms would lead to suppose was the case. One must be struck by the rapid subsidence of the edema and the abeyance of all symptoms which for the moment appear alarmingly grave. However, in these extreme cases the temperature, the intensity of the edema, the pain and discomfort, although to some extent measuring the severity of the condition, are not in themselves the deciding factors so far as the prognosis and the form of treatment to be instituted are concerned. Our one great problem is to determine when an ethmoidal infection has become orbital, in the sense that there is active inflammation of the orbital tissues.

We know that infection may gain access to the orbit by the following routes: *1.* actual necrosis of the bony lamina, *2.* by way of dehiscences in the os planum, *3.* along the blood

vessels of the sutural tesselations, and 4. through the blood stream. Irrespective as to the channel through which the infection enters the orbit, the signs which usher in this active invasion are made manifest by a general increase in the intensity of the symptoms already present. More important, however, are the local findings of fixation of the eyeball and induration of the tissues. Both these signs indicate a definite break in the limiting wall between the ethmoid and orbit with entrance into the orbital cavity of the infectious process. This invasion implies that an effort is being made on the part of Nature to limit the mobility of the involved area, a phenomenon observed very commonly in other regions of the body and hence the development of fixation. Furthermore, the appearance of the induration and associated redness signify an attempt on the part of the tissues to wall off and limit the infectious process which now has become proximal.

I am of the opinion that as long as fixation of the eyeball and induration of the orbital tissues are absent, the infection is still intralabyrinthine or, rather, extraorbital, in the sense that the case is still amenable to conservative intranasal treatment. As soon as the globe becomes definitely fixed and especially if associated with induration which shows a tendency to increase, the case is then purely surgical and conservative measures are contraindicated.

Faulkner agrees that fixation, whether present or absent, is very important in the matter of prognosis as to whether the patient will escape an operation or not. He believes the fixation results most probably when the cells far back in the orbit are involved and broken down. I have operated a case externally in which fixation was definitely present and the break occurred in the anterior cells, as evidenced by an opening in the lamina close to the lacrimal bone. I, therefore, am of the opinion that fixation does not depend so much upon the location of the break in the lamina as it does upon the fact that one exists.

Diagnosis: In a case of ethmoiditis associated with orbital complications the clinical picture is fairly typical. As a rule, there are present the symptoms of the preceding upper respiratory infection or one of the exanthemata, particularly scarlet fever. In two of the cases herein reported the patients

developed orbital manifestations in the early days of scarlet fever.

The eye symptoms may appear without any premonitory signs. When these patients are old enough they frequently complain of headache, and in infants this pain is expressed by unusual restlessness. Slight swelling of the nasal half of the upper eyelid on the affected side is noted. The former droops and the palpebral fissure becomes narrowed. As the edema increases the lower lid shares in the swelling and the eye becomes closed. As the condition progresses the edema involves both palpebral and bulbar conjunctiva and then spreads to the surrounding parts. In a considerable number of cases the eye appears to be pushed forward in its socket, a true exophthalmos. It may be rotated and pushed outward and upward. There is lacrimation and acute sensitiveness to light and to pressure upon the eyeball. The fundus examination is usually negative except for tortuosity of the retinal veins.

At this stage the sight is unimpaired, and although there may be exophthalmos there is no limitation of mobility of the eyeball. The swelling of the lids and surrounding tissues is soft and may be reddened but there is no actual induration. The general symptoms may appear severe; the temperature reaches 102° to 104° and even higher; the pain may be continuous and extreme in nature and the patient seems gravely ill.

Examination of the nose after suitable cocainization discloses a numer of interesting findings. One can with a great deal of patience and gentle persuasion coerce these little children into permitting the insertion of the naso pharyngoscope and thus gain at a glance the desired information. In all these cases of ethmoiditis in children the endoscopic picture is very definite and typical. On the affected side one finds the mucosa of the middle turbinal markedly edematous. This edema is especially noticeable at the posterior end and extends upward to its attachment, giving the typical bottle-shaped turbinal. More characteristic, however, is the absence of the normal recess formed by the external surface of the middle turbinal and the lateral wall. In its place one sees the mucosa of this space markedly edematous and protruding way beyond the posterior border of the middle turbinal. This

finding is very characteristic and always points to involvement of the ethmoid cells. It is also found, but not to the same degree, in antrum infections. All the tissues are glistening and bathed in secretion. Once having observed this picture, it is not difficult to make a diagnosis in subsequent cases.

X-ray of the sinuses is indispensable. Examination usually reveals the clouded ethmoid cells on the affected side. It is interesting to note that the anterior group of cells are the ones most often involved. On the other hand, the posterior group may share in the clouding. Occasionally, there will be simultaneous involvement of the antrum on the same side. When a frontal sinus is appreciable, that also shows evidence of edema and swelling of the lining membrane. Fig. 4 shows

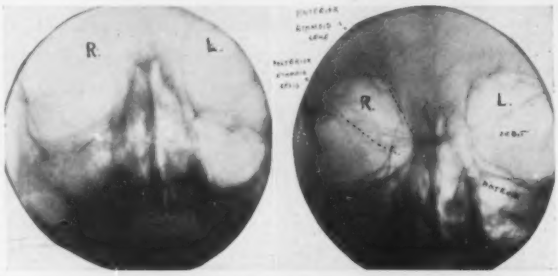

Fig. 4, Case 7. Shows involvement of the anterior ethmoid cells and maxillary sinus on right side. Plates taken on fourth day of eye symptoms.

the typical Roentgenological findings. In this case the anterior ethmoids and maxillary antrum were involved.

For some time I have attempted to demonstrate this displacement of the lamina by a study of the Roentgenological findings in those cases that have come under my observation. However, a number of obstacles were encountered. In the first three cases it was difficult to obtain X-ray plates when the orbital symptoms were still a prominent part of the picture. In the next two cases the X-rays that were taken were not properly centered so that I could not make accurate measurements. However, I was finally able to obtain a set of films in both Cases 8 and 10. Particular attention was paid to centering these plates so that more accurate meas-

urements could be ascertained. A careful study of Figs. 5 and 6 will help to justify the theory I have propounded regarding the dilatation of the ethmoid labyrinth in inflammatory disease in children.

The most prominent part of the inner orbital wall, as seen by the X-ray in the anteroposterior position, is the lamina. The external orbital wall shows two shadows corresponding to the anterior and posterior ridges of the malar bone. Owing

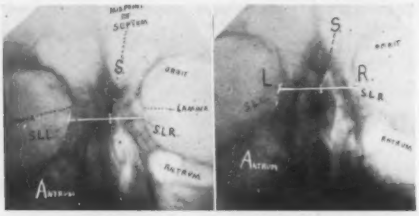

Fig. 5. Case 8. S—Midpoint of septum; L—Lamina; SLL—Distance from midpoint of septum to lamina on the diseased side, 16 mm.; SLR—Distance from midpoint of septum to the lamina on the normal side, 13 mm.

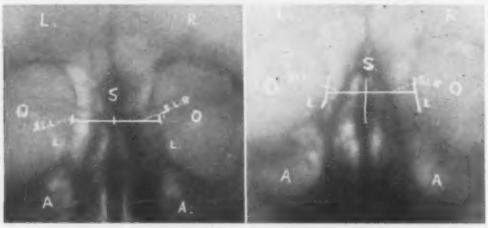

Fig. 6, Case 10. S—Midpoint of septum; L—Lamina; SLL—Distance from midpoint of septum to lamina on the normal side, 14 mm.; SLR—Distance from the midpoint of the septum to the lamina on the diseased side, 18 mm.

to the fact that the latter has a broad surface, these ridges are easily displaced with the slightest tilting of the head so that they cannot be utilized in obtaining accurate measurements.

I, therefore, took the center of the bony septum high up, where it is not likely to be deviated and measured from this point to the lamina on each side. Thus in Case 8 the distance from the midline to the lamina on the normal side was 13 mm., and on the diseased side, 16 mm. Likewise, in Case 9 the distance from the septum to the lamina on the normal

side was 14 mm., and on the diseased side, 18 mm. From these plates there is no doubt that the involved ethmoid labyrinths were both dilated. However, nothing conclusive can be drawn from the study of two cases, but I do hope that the presentation of this theory, however fanciful, might arouse sufficient interest among some rhinologists to aid me in further Roentgenological study of these cases.

Treatment: As I have pointed out before, in a consideration of the therapeutic measures the question of utmost importance is to determine, first of all, whether the case is one which calls for conservative measures or whether it is one in which radical surgery is indicated. It seems to me that we have two definite indications that govern the procedure to be followed. Fifteen years ago a patient who entered a hospital with edema of the eyelids and conjunctiva, especially with high temperature, was at once considered a most urgent surgical case. Little time was wasted in rushing this patient to the operating room to have his orbit explored. I am certain that many rhinologists recall this tenure of administration in their interne days. But in the light of our present knowledge we feel certain that some of these cases may have recovered with conservative treatment. As I have previously stated, the two indications which render a case surgical are fixation of the eyeball and induration of the tissues. As long as these findings are lacking, irrespective as to what other signs and symptoms may be present, the case is still one that is amenable to conservative intranasal treatment. However, with the spread of the infection beyond the lamina into the orbital tissues, the case then assumes a different aspect. At this stage we are dealing with a severe orbital phlegmon and conservative measures are not only futile but may even jeopardize the life of the patient. On the other hand, the error of commission is just as sinful as that of omission. Surgical interference has its definite place in cases of this kind, and should not be instituted prematurely when conservative measures may still be sufficient to cause subsidence of the infection. Operations on the orbit and the ethmoid sinuses in infants and young children are often complicated by meningitis. Sutures are still open; foramina are wide; bony partitions are almost membranous in nature and supplemented by the rich blood and lymph exchanges that take place in growing skulls, extension into

the brain cavity is common. For these reasons, therefore, it is of vital importance to refrain from such radical procedures until one is absolutely certain that they are indicated.

The conservative treatment in the cases of ethmoiditis associated with orbital complications has as its basic principle the reduction of the intense edema of the mucosa of all the structures in the middle and superior meatuses and the evacuation of the contents of the ethmoid cells. From a discussion of the pathology we know that ethmoid disease in children is especially characterized by marked swelling of the tissues. It is this fact which is responsible for the interference with drainage of the products of inflammation from the involved ethmoid cells. Therefore, astringents must be employed for the purpose of shrinking the mucous membrane. After this has been accomplished our attention must be directed toward emptying the overfilled and distended ethmoid cells. I have found that the introduction of astringents serve very little purpose if sprayed or instilled into the child's nose unless the head is placed in such a position as to permit these solutions to come in direct contact with the mucosa of the middle and superior meatuses. In order to accomplish this end, one must place the head in the position which will allow the solution to enter this region and remain so for a maximum length of time. The head resting over the end of a table, similar to the position described by Proetz[15] for filling the sinuses, is the one most desirable. The head is held in this position for at least ten minues. Then the patient is permitted to sit up and suction applied. The astringent I find to be of best service is the aqueous solution of ephedrine sulphate, 3 per cent strength. From five to ten minims are instilled into each nostril.

Of all sinus conditions in which suction is used none can compare with its usefulness and efficacy when employed in cases of this kind. The method of applying suction, I believe, is a very important consideration. I use a four-ounce bottle with a rubber stopper perforated to admit two "l" shaped glass tubes. The shorter of the two is attached by a long rubber tube to the suction pump. To the other is attached a short tube six inches in length, at the other end of which I adjust a nasal tip of hard rubber. These tips are of varied length and sizes in order to suit the individual nose. The

rubber tubing which connects the nasal tip to the bottle is of a special kind. It takes many hours of boiling to get the proper elasticity and resiliency. It must not be too soft for it collapses readily with the slightest amount of suction and thus ceases to act. If it is too hard and stiff, it will resist the suction of the pump and fail to collapse, no matter how high it rises. This failure to collapse permits the pressure to rise beyond that point which the patient can tolerate. Not only does this cause severe pain but it also produces rupture of the capillaries with bleeding. The latter is one thing that must be avoided. When the rubber tubing is of the proper kind it will collapse of its own accord as soon as the suction reaches a given maximum. This collapse of the tube can be aided by pressure of the fingers so that we can control the amount of suction desired to be used against the nasal chambers. If I wish to get maximum suction I permit the tube to collapse of its own accord. If I wish to vary it I can do so by compressing the walls of the tube with the fingers. In these cases I use the maximum of pressure, and it is surprising how well these children tolerate it. Most of them cry throughout the treatment and the crying act aids the suction because it shuts off the pharynx as does the saying of "K-K" in the adult. Fig. 7 shows the arrangement of the suction bottle and tips.

With the proper preparation of the nose the secretion from the sinuses begins to flow very readily into the suction bottle. The evacuation of the secretion is usually followed by relief, which at times is almost miraculous. I have seen extensive edema recede appreciably within an hour or two after application of the first treatment.

The suction treatments are given twice daily in severe cases, and once daily in the milder ones. This is continued as long as any edema is present. In the interim the astringent is used at frequent intervals with the head in the usual position. This intermittent shrinkage of the mucosa in itself favors natural drainage from the infected sinuses.

Externally, cold compresses are applied over the edematous tissues. Patients derive a great deal of comfort from them and they also tend to diminish the edema.

General supportive treatment should be used and the pain if severe may be relieved with suitable narcotics. Attention

to the bowels and diet and other general hygienic measures should be instituted.

As a rule, within 48 to 72 hours general improvement is noted. The temperature drops and the pain becomes less severe. The edema of the lids begins to subside and chemosis of the conjunctiva disappears.

Those cases which yield to this form of treatment are usually well in from 10 to 14 days. Occasionally, all the local signs disappear within the first three to four days, but the secretion continues for at least two weeks.

All the cases here reported have been under observation from three and one-half years to eight months and all have remained well without the slightest evidence of recurrence.

CASE REPORTS.

Case 1: S. R., male, age 4 years; was referred to me on Jan. 6, 1930, by Dr. S., with swelling of the right eye and severe headache of 48 hours' duration.

Previous Personal History: At 2 years of age the patient had a tonsil and adenoid operation; otherwise he enjoyed good health.

Present Illness: Ten days prior to my first examination the patient took sick with a severe upper respiratory infection. This was accompanied by frontal headache, red throat, cervical glands, and a profuse nasal discharge. After five days the temperature reached and remained normal. The next two days were uneventful except for the development of marked nasal obstruction on the right side. All measures used to obtain relief were of no avail. On the eighth day the patient complained of severe frontal headache and the temperature rose to 103.4.° The child vomited several times that evening. The next morning a swelling appeared at the inner canthus of the right eye and by evening of the same day the upper and lower lids were edematous and the eye could not be opened.

The child spent a restless night and complained of severe headaches. The temperature rose to 104° in the morning.

The edema extended to the forehead and the child appeared gravely ill.

The patient was seen by an ophthalmologist, who advised immediate operation. There was some hesitancy on the part of the parents to submit to such an operation, and a rhinologist was consulted. He was in disagreement with the ophthalmologist. That same evening the child was referred to me.

Examination revealed marked edema of the upper and lower lids, glabella and frontal region. The bulbar and the palpebral conjunctivae were chemotic. Although the upper lid was reddened, the tissues were soft and there was

Case 1. Photograph taken five days after onset of eye symptoms and three days after treatment was begun.
Case 2. Photograph taken three days after onset of eye symptoms and one day after treatment was begun.
Case 3. Photograph taken five days after onset of eye symptoms and two days after treatment was begun.

absence of induration. The eyeball appeared normal and made the normal excursions in all directions.

Intranasal examination with the nasopharyngoscope was somewhat difficult. The child was very refractory but after suitable cocainization I was able to visualize the postnasal space. The middle turbinal was edematous and the mucosa of the middle meatus protruded in characteristic fashion. There was, however, very little secretion visible in the nasopharynx. All these findings were made more conspicuous when compared to the other side, which was practically normal.

Therefore, with the absence of fixation of the eyeball and induration of the tissues, I advised intranasal treatment. Owing to the high temperature and the inclement weather, I attended the child at home. On the first three days he received two treatments daily. After that, one treatment each

day was found sufficient. Within 12 hours the edema began to subside and the headaches ceased almost completely. The temperature continued as high as 102° until the fourth day, when it dropped to normal. From then on the treatments were given at the office. Adrenalin chloride, 1:1000, was the astringent used and at the home I employed the portable Yankauer suction pump.

The patient continued treatment for 14 days, at the end of which time he was discharged as cured. It is past three years since his attack and he has remained well up to date.

Case 2: C. B., male, age 3 years; was referred to me on March 3, 1930, by Dr. W., with high temperature, severe headaches and pain in the right ear.

Previous Personal History: The child has had frequent attacks of ear pain and for the past two winters he had his eardrum incised for suppurative otitis. He was subject to frequent head colds, despite the fact that his tonsils and adenoids had been removed when 18 months old.

History of Present Illness: Six days before my examination the child took sick, with temperature and vomiting. A day or two later according to his family physician, Dr. W., a typical scarlet rash appeared, with all the associated scarletinal phenomena. I was asked to see him because of the pain in his ear and the severe headache, which seemed limited to his left forehead. At this examination I found his eardrum slightly congested and evidences of an acute accessory nasal sinusitis. The status of the child remained the same until March 6, when he developed a swelling of the inner canthus and upper eyelid. That same afternoon the lower lid shared in the edema and by the next morning his eye was completely closed. My examination at this time showed edema of the upper lid, the swelling extending up on to the forehead and temple of that side. There was chemosis of the palpebral conjunctiva. The eyeball showed no evidence of fixation and fundus examination was negative. Although the edema was rather extensive, associated with redness, there was no evidence of any induration. Nasopharyngoscopic examination disclosed marked edema of the middle turbinal and the mucosa of the middle meatus. There was an abundance of thick, tenacious mucus in the nasopharynx.

In the absence of fixation of the globe and induration of the tissues the patient was treated conservatively. He received bi-daily treatments for the first four days. They consisted of the application of adrenalin chloride, 1:1000, to the structures of the middle meatus, followed by suction. This patient began to improve within 12 hours. The swelling receded quickly and within 72 hours it had entirely disappeared. Treatments, however, were continued for two weeks, at the end of which time recovery was complete.

Case 3: M. R., male, age 5 years; was referred to me on Oct. 7, 1930, by Dr. M., with the following complaints: swelling and protrusion of the eye of three days' duration, with severe headache and temperature.

Previous Personal History: The patient was a chronic nose sufferer. He had had sinus trouble all his life.

History of Present Illness: Two weeks prior to my examination he had a severe grippe infection. The outstanding symptoms in the course of his illness were the associated severe headaches. They seemed to be constant and required narcotics to alleviate them. Three days before he was referred to me, a swelling appeared on his left upper eyelid, which gradually spread to involve all the upper and lower lids, the bulbar and palpebral conjunctivae, forehead and cheek on that side. The swelling remained the same up to the time of my examination. At this time I noted the above findings with constant lacrimation and exquisite sensitiveness to light. The mobility of the eyeball was only slightly impaired upon inward movement. There was absence of induration. The swelling, although extensive, was not discolored. Vision was unimpaired and the fundus showed some fullness of the retinal veins. Nasopharyngoscopic examination was carried out with great difficulty in this patient owing to the presence of a badly deflected septum. However, by introduction through the normal side I was able to visualize some of the edema of the affected side and especially the profuse secretion in the nasopharynx.

The patient received the usual treatment: astringents followed by suction. These treatments were carried out in my office, the patient making two visits daily for the first four days and once daily thereafter. The symptoms subsided and the edema receded to a great extent. However, the upper

eyelid remained full until the fourth week, when fullness also disappeared, and the patient was discharged as cured.

Case 4: E. S., female, age 7 years; was referred to me on March 3, 1931, by Dr. B. This child had been admitted to one of the hospitals for immediate operation.

Previous Personal History: Irrelevant.

History of Present Illness: The patient had an upper respiratory infection and on the fifth day of her illness developed severe headaches. Two days later a swelling appeared in the inner canthus of her left eye and rapidly spread to involve the lower lid on that side. The condition grew progressively worse and in 48 hours the edema extended over

Case 4. Photograph taken six days after onset of eye symptoms and three days after treatment was begun.

Case 5. Photograph taken 36 hours after onset of eye symptoms and before beginning any treatment.

Case 6. Photograph taken five days after onset of eye symptoms and three days after treatment was begun.

the glabella to involve the eyelid of the other side. The swelling was red and tense. Her temperature rose to 105,° she was delirious and appeared gravely ill. A rhinologist and an ophthalmologist after deliberation advised that the child be operated externally. She was sent to the hospital that same day. I was asked to see her that evening. Upon examination I found all the above signs and symptoms manifest. Nasopharyngoscopic examination showed the bottle-shaped middle turbinal and an unusually marked edema of the mucosa of the middle meatus. This patient was X-rayed and the findings were those of a severe anterior and posterior ethmoiditis associated with clouding of the antrum on that side. There was absence of definite fixation and induration, even though the edema of the tissues was associated with redness. Therefore, I advised procrastination of operative interference. The patient was treated conservatively with

astringents, suction, wet dressings, steam inhalations, and within six days all the acute symptoms subsided and all that remained was an edema of the upper lid. This edema persisted for three weeks after which time the lid became reddened and a small area of pointing appeared. This was incised and several drops of pus were liberated. The abscess healed in a few days and the patient was discharged as cured five weeks after her initial treatment.

Case 5: R. B., male, age 12 years; was referred to me on June 4, 1931, by Dr. W. His chief complaints were severe headaches, swelling of the eyelids and high temperature.

Previous Personal History: The patient had always been subject to head colds. His tonsils and adenoids had not been extirpated.

History of Present Illness: One week prior to my first examination he had a grippe infection, which ran a most severe course. His temperature ranged between 100° and 105° and he suffered severe frontal and occipital headaches. On the sixth day of his illness there suddenly appeared a swelling in his upper eyelid, which rapidly spread to involve the lower lid and entire side of the face and forehead. It was interesting to note that his headaches, which seemed to be his main concern throughout his illness, subsided rapidly with the appearance of the orbital swelling. These findings were of 36 hours' duration when I was asked to see the patient. Despite his temperature, which was 103.6,° and the edema of half his face and forehead, he seemed to be in a most jovial mood. Having been informed of the sort of case I was to see, I took my camera with me and so snapped him even before I proceeded to examine him.

This case seemed to be of a most severe type. His palpebral and bulbar conjunctivae were markedly chemotic and became much worse on the following day. Although the edema was extensive and appeared reddened, no induration could be discerned. The eyeball was definitely pushed forward and displaced outward and downward. The eyeball was exceedingly sensitive to pressure and lacrimation was intense. There was some limitation of the convergence of the globe of the affected side, but all other excursions were not interfered with. The fundus showed no changes except for tortuosity of the vein.

Nasopharyngoscopic examination revealed marked edema of the middle turbinal and the mucosa of the middle meatus.

In the absence of fixation of the eyeball and induration of the edematous tissue, I advised conservative measures.

This patient co-operated very well. The ephedrine in this case was applied with an applicator directly to the middle turbinal, middle meatus and olfactory fissure. Suction was employed in this case with unusual satisfaction. Two treatments were given daily for the first three days, after which one treatment every 24 hours sufficed.

Within 36 hours most of the edema of the eyelids had receded. His temperature began to drop 12 hours after the first treatment and was normal on the fifth day. Treatments were continued until the fourteenth day, after which date he was discharged as cured.

Case 6: L. P., male, age 11 months; was referred to me on Aug. 3, 1932, the chief complaints being high temperature and swelling of the right eye.

Previous Personal History: For the past winter the child had repeated head colds and several attacks of acute suppurative otitis media.

History of Present Illness: One week prior to my seeing the child, he had a severe head cold which was accompanied by a bilateral otitis media. The drums were incised two days after the beginning of his illness. However, the temperature persisted and the child was very restless at night and cried continuously. An outstanding feature to which the mother called my attention was the marked nasal obstruction that accompanied the head cold. Such difficulty in breathing had not been noted before in the previous attacks. Four days after the incision of the drum membranes there appeared a puffiness of the right upper eyelid, which soon spread to involve the lower eyelid area. By the evening of the same day the eye was completely closed. The temperature rose to 105° and the child was extremely fretful.

I saw the child for the first time on the second day after the eye symptoms made their appearance. The eyelids were closed and there was marked chemosis of the conjunctiva.

The edema of the lids disclosed no evidence of induration and the eyeball moved freely in all directions. The temperature was 104.6° and the child seemed very ill.

Nasal examination was carried out with great difficulty owing to the narrow and almost inaccessible nasal chambers. In this case I felt certain as to the diagnosis without the necessity of further investigation. In the absence of induration and fixation of the eyeball, I advised conservative treatment.

This child received treatment in my office. After a preliminary application of adrenalin to the middle meatus region, I employed suction and it was most effectual. The sinuses were soon emptied of their contents. By the next morning the edema had receded so that the palpebral fissure was open. It was most gratifying to hear that the child slept that night for the first time since the onset of its present illness.

The temperature reached normal on the third day and remained so thereafter. Treatments were continued daily for one week, at the end of which time all inflammatory symptoms had disappeared.

The child was discharged one week later with dry middle ears and the nose apparently normal.

Case 7: V. B., male, age 6 years; was referred to me on Sept. 1, 1932, complaining of swelling of the eyelids and high temperature.

Previous Personal History: This patient had been allergic all his life. He had eczema of a severe type up to 2½ years of age. For the past two years he had severe attacks of asthma. A tonsil and adenoid operation was performed at the age of 4 years. However, he was subjected to frequent head colds, which oftentimes ushered in the asthmatic seizures.

History of Present Illness: Ten days previous to my first examination the child developed high temperature, headaches and vomited several times. Forty-eight hours later a typical scarlet rash appeared. The latter was of a most severe type and was accompanied by a temperature of 105,° which persisted for one week. Twenty-four hours before he was referred to me he developed edema of his right lower lid. This rapidly spread by the next morning to involve the upper lid and forehead.

I saw the patient on the evening of Sept. 1 and noted marked edema of the upper and lower lids, forehead, cheek and temple of the corresponding side. Both the bulbar and palpebral conjunctiva were chemotic and the eyeball appeared to be distinctly more prominent than its fellow. The edema of the skin was slightly discolored and glistening. There was, however, no evidence of induration.

Intranasal examination by anterior rhinoscopy disclosed a right nasal chamber that was completely closed so that one could not visualize the structures above the inferior turbinal. Nasopharyngoscopic examination showed the entire mucosa of the middle turbinal and the middle meatus to be pale and markedly edematous. The mucosa of the middle meatus protruded way beyond the posterior end of the middle turbinal so that it appeared like an enormous polyp. I attributed this intense edema, which to me was unprecedented, to the child's allergic state.

All movements of the globe were free; vision was normal and the fundus showed no changes.

In view of the fact that there was neither induration of the tissues nor fixation of the eyeball, I advised conservative measures. In this particular case the suction had to be employed for a much longer period. Even the astringents did not seem to have the same effect as in other cases. However, after 12 days with treatments twice daily the edema gradually subsided and the orbital tissues returned to normal. The temperature persisted, however, for more than one week after treatment was begun. This child subsequently developed an acute nephritis. In the fourth week of scarlet, after the eye symptoms had completely subsided, he developed a bilateral otitis media and finally a right surgical mastoid. This was operated and the child made an uneventful recovery.

Case 8: F. O., female, age 7 years; was admitted to the Beth Moses Hospital on Feb. 3, 1933. Her chief complaints were high temperature, severe headache and swelling of the left eye.

Previous Personal History: The patient was born with a congenital heart (patent ductus arteriosus). She was subject to frequent head colds, although she had had a tonsil and adenoid operation when 4 years of age. She also had, on two occasions, attacks of rheumatic fever.

History of Present Illness: One week prior to admission to the hospital she suffered a severe grippe infection. Following this, she complained of severe frontal and occipital headache. On the fifth day of her illness the left upper lid became swollen and by the evening of the next day the lower lid, forehead and cheek shared of the edema. Her headache was intense and was referred to the left side. Her admission temperature was 105.° Examination by me on the evening of admission disclosed this extensive edema above described. The tissues were red, somewhat discolored, and the skin was tense and glistening. No induration of the tissues was discernible, however. There was some chemosis of the palpebral

Case 8. Photograph taken on fourth day after onset of eye symptoms and one day after the beginning of treatment.

Case 9. Photograph taken on third day after onset of the eye symptoms and one day after the beginning of treatment.

Case 10. Photograph taken on fourth day after onset of the eye symptoms and before any treatment was given.

conjunctiva but that of the eyeball showed no change. The globe was definitely more prominent when compared with the other side and seemed to be displaced outward and downward. The movements of the eyeball were apparently normal with the exception of extreme inward rotation.

There was moderate sensitiveness to light and exquisite pain was elicited upon pressure over the eyeball and especially over the inner canthus region and lateral aspect of the nose.

After suitable cocainization of the nasal mucous membrane, examination by anterior rhinoscopy disclosed marked edema of the left nasal passages. Owing to this intensive swelling nothing could be made out in the region above the inferior turbinal. Nasopharyngoscopic examination revealed the typical bottle-shaped middle turbinate and edema of the entire middle meatus.

Eye grounds were normal except for some congestion of the retinal veins. Vision was unimpaired.

X-ray examination showed a dense shadow in the left anterior and posterior ethmoid cells and the maxillary antrum on that side. Careful study of this plate showed a definite widening of the ethmoid labyrinth as compared with the normal side. I have called attention to these plates earlier in this paper.

In the absence of induration of the soft tissues and fixation of the eyeball, despite the fact that the patient appeared gravely ill, I advised conservative measures. That same evening the nasal mucosa was shrunken with direct applications of adrenalin chloride, 1:1000, and suction applied to the affected side. There was a considerable amount of mucopus withdrawn. Shortly after her first treatment the headache lessened and by the next morning it had completely disappeared. The temperature, however, remained unaffected. During the next four days the patient received one treatment daily. Cold compresses were used externally, which afforded great relief to the patient. On the eighth day after the beginning of the suction treatments the edema of the lids had completely receded and the orbital tissues were apparently normal. All tenderness along the lateral nasal wall had disappeared and it seemed that the patient was to make an uneventful recovery. That there was absolute justification in the employment of conservative measures in this case must be evidenced by the fact that all signs and symptoms of orbital involvement had disappeared and her acute sinus infection had completely subsided.

The patient, however, had a congenital heart and subsequently developed an acute endocarditis. This was further complicated by a septic pneumonia. She finally succumbed to a terminal meningitis.

The advent of these complications were coincidental and I do not believe they resulted from the form of treatment employed. Just as any local infection may act as a focus and ultimately give rise to a general sepsis, so may an infection of the sinuses be the source of origin for such general invasions. One would be more apt to attribute the complications that followed to any surgical interference had such measures

been resorted to in the treatment of this case. However, I feel the selection of the type of treatment that was employed in no way had any bearing on the various complications that followed.

Case 9: P. P., male, age 3 years; was referred to me on June 8, 1933, by Dr. F. His chief complaints were swelling of the left eye, temperature and pain in the head.

Previous Personal History: The patient had enjoyed comparatively good health up to six weeks ago, when he became ill with chickenpox. This was followed by a mild form of measles. Two weeks later the patient had an acute head cold. The symptoms of the latter soon subsided but he continued to have a profuse nasal discharge, which was limited to the left side only. This persisted up to the onset of his present illness.

History of Present Illness: Four days prior to my first examination the patient became very irritable, developed temperature and complained of headache. He cried at night and seemed to be in severe pain. On the third day of his illness he awoke in the morning and his left upper eyelid was swollen. By the next morning both lids were involved.

Examination on June 28 revealed marked edema of both eyelids. The skin was somewhat discolored, tense and glossy in appearance. Induration of the tissues was not present. Palpation of the lamina elicited severe pain. The eyeball was sensitive but moved freely. Its mobility was unimpaired.

Rhinoscopic examination disclosed marked edema of the mucous membrane of the entire left nasal chamber so that one could not visualize any structures. The temperature at this time was 103.°

The diagnosis was very evident and I refrained from any further investigation. In view of the fact that there was absence of induration of the tissues and no evidence of fixation of the eyeball, I advised conservative treatment.

Accordingly, therefore, the left nasal chamber was packed with adrenalin chloride solution, 1:1000, and permitted to remain for 15 minutes. After its removal I applied suction and obtained an abundance of purulent material. At home the patient received the usual intranasal instillations of ephe-

drine sulphate solution, 3 per cent, at frequent intervals. In addition, cold compresses of boric acid solution were applied to the affected eye. It was interesting to note that two hours after the first treatment the child was no longer irritable. His temperature dropped to 101° that evening and he slept for the first time in five days. Treatment was continued daily and on the sixth day the edema had completely subsided. The patient was discharged at the end of the second week as cured.

Case 10: L. O., male age 9 years; was admitted to the Beth Moses Hospital on May 12, 1933, the chief complaints being swelling of the right eye, headache and high temperature.

Previous Personal History: The patient had measles at 4 years of age. He was always susceptible to head colds. His tonsils and adenoids were extirpated at 6 years of age. Aside from this the patient enjoyed comparatively good health.

History of Present Illness: On the morning of May 9 the patient awoke with a severe headache, limited to the right frontal and occipital regions. Along with this there was temperature of 103.° During the same day he vomited several times and appeared very ill. The next morning a swelling of the right upper eyelid was noted and by the evening of the same day it had progressed to involve the lower lid. The following day the child was sent to the hospital.

Examination May 14, 1933. The patient seems very ill. The temperature is 104,° pulse 124, respiration 28. There is present marked edema of the upper and lower right eyelids. The swelling also involves the bridge of the nose and the cheek of the same side. The skin is red but no induration of the tissues is noted. The eyeball is not involved. Its mobility is not impaired, but it appears to be slightly exophthalmosed. Vision is normal. Nasopharyngoscopic examination discloses the typical edema of the middle turbinal. The middle meatus is completely obliterated and the mucous membrane of the latter protrudes beyond the posterior end of the middle turbinal. All the tissues are edematous and bathed in secretion.

Blood count shows hemoglobin, 80 per cent; R.B.C., 4,200,000; W.B.C., 17,000; with 77 per cent polys. Urine examination negative.

X-ray examination disclosed clouding of the right ethmoids, especially the anterior group of cells. The plates are noted in Fig. 6. In this case particularly the swelling of the ethmoid labyrinth caused definite displacement of the lamina.

There were none of the indications that called for surgical intervention. There was absence of induration and fixation of the eyeball and I therefore did not advise radical measures. This child was admitted on the pediatric service of the hospital. The attending pediatrist was adverse to the suction treatment and in view of the fact that there were no operative indications I consented to refrain from employing it in this patient. As a matter of interest I was very anxious to observe the course of this case. In studying the progress and ultimate outcome I am now more firmly convinced than ever before of the rational of my theory, in regards to the pathology and the treatment I advocate.

This patient recovered without treatment. That this occurred does not in any way prove the inefficacy of the suction treatment or rather its superfluity. One might use this form of reasoning in the therapy of diphtheria. Simply because cases recover without the administration of antitoxin would not lead one to conclude that its use was superfluous. This patient's edema subsided but it required a much longer time for the tissues to resolve. With active treatment resolution is hastened and the tissues return to normal in much less time. What was accomplished with suction, Nature did by permitting the sinuses to drain spontaneously. That this was so I must attest by the fact that repeated throat examinations revealed the presence of a profuse postnasal discharge, which the patient was continuously swallowing. The drainage in this case was mainly postnasal.

This patient had the signs and symptoms of threatened orbital involvement, as evidenced by marked and extensive edema of the lids and chemosis of the conjunctiva, severe pain in the head, high temperature, and Roentgenological findings indicative of dilatation of the ethmoid labyrinth and displacement of the lamina. For the moment this case appeared urgent and was one in which not so long ago surgical treatment would certainly have been instituted. It serves to prove conclusively that even though the picture was one in which infection of the orbit seemed imminent, neverthe-

less without the presence of the two operative indications to which I have called attention, the case was still nonsurgical. That this was so is indicated inasmuch as the patient recovered without operative interference. It is hardly conceivable for the infection to be intraorbital and have the patient recover so rapidly without treatment.

The edema in this case remained practically stationary until the sixth day, when it began to subside slowly. By the fourteenth day all symptoms had disappeared and the patient left the hospital on May 27, completely cured.

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FRONTAL LOBE ABSCESS (MULTIPLE) SECONDARY TO FRONTAL SINUSITIS, WITH REPORT OF A CASE.§*†

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The high mortality of frontal lobe abscess in spite of its comparative rarity merits a thorough study of the subject. With this thought in mind, the literature was studied in an attempt to determine the reasons for the mortality and to analyze those cases that recovered in order to draw certain definite deductions. These are to be correlated with the case report to be subsequently presented. The ultimate aim is to draw up certain principles, the use of which, it is hoped, will lessen the mortality and incidence of this condition.

Eagleton[1] places the mortality of frontal lobe abscess at between 75 per cent and 80 per cent.

There may be several factors to account for this:

1. What about the etiology? Is it beyond our control?

2. Are we unable to make a proper diagnosis till it is too late?

3. Is there any anatomical reason to account for its infection as well as its resistance to treatment?

4. In treating this condition, is there anything wrong in our method of approach and methods of drainage?

5. What about our postoperative treatment?

1. Etiology: a. Infection: It is interesting to note that with so much nasal suppuration and so little aural suppuration, the number of otitic brain abscesses is many times more numerous than those of nasal origin (900 adjacent middle

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fossa abscesses to 150 adjacent frontal lobe abscesses). The explanation of this offered by Eagleton[2, 3] is this: The nose and accessory sinuses are essentially a mechanism for the protection not only of the upper respiratory tract, but of the underlying bone of the nose and paranasal sinuses and the brain, whereas the mucous membrane of the mastoid antrum and cells is merely a cellular covering of the bone, which is easily destroyed, thereby allowing invasion of the bone. Histologically, the mucous membrane lining of the nose and paranasal sinuses consists of mucous glands, vascular erectile tissue, lymphatic vessels, ciliated columnar epithelium, all of which are for the purpose of removing infection or preventing deeper ingress of infection. Should they fail, the elastic lamina propria with its firm adhesion to the bone prevents the microorganisms from attacking the bone. When the protective mechanism of the nose is overcome, the protective mechanism of the brain tends to limit the infection by producing a pachymeningitis. First, the extradural part is involved after which the subdural space is attacked. Before a cerebral abscess can take place these barriers must be overcome. We see, therefore, that sinus infection (especially frontal sinus) is an important etiological factor in frontal lobe abscess.

Myers[4] pointed out that every opening in the skull through which nerves make their exit or blood vessels pass, either from within out or without in, constitutes a potential pathway for infection to enter the cranial cavity and that bacteria are able to pass through some openings more readily than others. He states further, that in 1896 Dreyfuss collected 19 cases of intracranial infection due to frontal sinus, whereas in 1908 Dreyfuss collected 88 cases, of which 36 were abscess of the frontal lobe, while Boenninghaus, in 1914, collected 87 cases of intracranial infections due to diseases of the frontal sinus.

Eagleton,[5] in 1922, reported 150 cases of frontal lobe abscess, 64 of which took their origin from the frontal sinus.

Ross H. Skillern and George M. Coates[6] added a series of 27 cases to the above, making a total of 91, which is about one-half of the 177 reported.

Ersner and Pressman[7] reported a case of frontal lobe abscess secondary to primary Vincent's infection of the nose.

b. Influence of Trauma: Trauma, when present, is an important contributing factor in the production of frontal lobe abscess, perhaps more so than in any other part of the brain. It occurred in three of the 27 cases in the Skillern-Coates series.[6] The mechanism of infection and trauma will be treated in a more comprehensive manner under the anatomical consideration.

2. Diagnosis: All authorities are unanimous in the opinion that diagnosis is of the utmost importance, the earlier made the better. Jason Dixon[8] states that no organ in the human body can conceal its trouble so thoroughly as a brain which harbors an abscess. Nor is there a pathologic lesion that explodes with such sudden and fatal results. He emphasizes above all a most careful and painstaking history. Hill[9] concurs with this view, stating that by this means our diagnostic acumen is improved. Sonnenschein[10] praises Eagleton's work in connection with the diagnosis and treatment of brain abscess. He describes vividly how Eagleton lays special emphasis upon a detailed, careful and exhaustive history taking, placing before himself a calendar and noting upon it the dates at which certain symptoms in the course of the disease have occurred. He is especially anxious to note at which time vomiting, chills, headaches or vertigo have appeared.

Barnhill[11] stresses a careful history and repeated physical examination of the head for foci of infection, with careful searching of tne ear and sinuses. His reasons are as follows: brain abscess never occurs spontaneously, but results from infection. Thus by finding a focus our diagnosis is helped in two ways, it makes it more probable that a brain abscess really exists and assists in the location of it in the brain itself because in the majority of cases the brain infection occurs in tissues close to and adjoining the primary focus.

Eagleton[12] has prepared an excellent guide for a detailed neurological examination in the Cranial Surgery Department of the Newark Eye and Ear Infirmary. This guide is applicable to either conscious or unconscious patients and enables hospital residents or trained attendants without special training in neurology to conduct a detailed neurological examination. In the main, this guide consists of the following: Resume of history, resume of outstanding symptoms, resume of any abnormal neurological findings, general neurological symp-

toms, general neurological examination, cerebral localization and examination of the cranial nerves. Whenever a definite focus of suppuration is known to exist in the ear, nose and throat or lungs and a case presents cerebral symptoms, one must be on the lookout for brain abscess. The writer will confine himself only to frontal lobe abscess.

What are the specific symptoms and signs to look for: *a. Initial Vague Chill:* The rhinologist should always question carefully for this symptom because it arises when the infection has invaded the brain tissue, and by ascertaining the date of this chill, much information can be obtained about the formation of the abscess, its duration and virulence. *b. Headache:* This, in the opinion of Eagleton,[13] is always present. It may be dull or very severe. The headache of a patient with brain abscess is unlike any other type of headache, except possibly brain tumor. It is unrelieved by any form of medication, is constant and tends to become progressively worse. It was present in 22 cases in the 27 of the Skillern-Coates series.[6] *c. Vomiting:* Meningeal or cerebral suppuration very often induces vomiting. This symptom should be carefully sought for. It occurred in eight cases of the Skillern-Coates series.[6] *d. General Malaise and Slow Cerebration:* This symptom is sometimes present. There is a loss of strength, a dry skin and loss of flesh. It occurred in seven cases in the Skillern-Coates series.[6] *e. Slow Pulse:* This is a distinct symptom of cerebral compression and often may be associated with retinal changes. If the pulse rate be carefully watched, one will see a subnormal drop followed by a return to normal. The dip in the pulse rate is probably due to an acute edema, the returning to normal when the edema subsides or compensation is established, as pointed out by Eagleton.[14]

The term given to this dip in pulse rate, while the temperature is either stationary or rises slightly, is Macewen's sign. B. H. Shuster[15] attaches a great deal of importance to this sign because it is an unfailing sign of intracerebral suppuration. It was present in seven of the 27 cases of the Skillern-Coates service,[6] but as stated by our Chief of Service, Dr. Coates, that if temperature and pulse rates were taken hourly or every two hours, a larger percentage of Macewen's signs would be reported, not only in this series, but generally. *f. Subnormal Temperature:* When a brain abscess is present,

the body temperature is as a rule either normal, subnormal or only slightly elevated. A number of theories have been advanced to explain why the body reaction to a suppurative process in the brain is so feeble as to scarcely give any temperature rise.

Eagleton[16] enumerates and comments on the following: interference of the heat-regulating mechanism of the brain by cerebral suppuration, stimulation of the vasomotor center, secretions from the brain in relation to temperature control, etc. It was observed in five of the 27 cases in the Skillern-Coates[6] series. *g. Papilloedema:* This is present, as a rule, where there exists an intense cerebral compression, though it may be absent. It is usually absent in mild or moderately severe compression. Papilloedema will be discussed in connection with the case report. It goes without saying that an ophthalmologic examination in all suspected brain abscess cases is a *siné qua non. h. Cerebrospinal Fluid Studies:* Where lumbar puncture is not contraindicated, it is well to have a complete study made of the cerebrospinal fluid pressure, chemistry, bacteriology and cytology. Thus valuable information is obtained about the pathology in the brain, *e.g.*, mild increase in cell count between 100 and 200 is often found in brain abscess. *i. Convulsions:* Convulsions occurring in the presence of a suppurative focus in the nose (or ear) indicate intracranial extension of that focus. Eagleton[17] says that frontal lobe abscesses in children cause frequent convulsions. Dixon[8] reports a case of an adult having had 52 convulsions in 20 hours where necropsy revealed multiple abscesses involving both hemispheres of the brain and with no evidence of a primary focus or skull fracture. Three months previous to hospital admission this patient fell off a scaffold and was momentarily unconscious.

j. Coma: This is the terminal stage of compression. When this occurs the suppurative process of the brain progresses till all the cerebral tissue becomes permanently damaged. Any operative or expectant procedure during this stage is usually futile.

It is important to repeat that given a suppurating focus in the frontal sinus, or ethmoids, or both frontal and ethmoids; in the orbit, an osteomyelitis of the frontal bone, or a focus originating in both the orbit and posterior sinuses,

following which the specific symptoms and signs of intracerebral involvement declare themselves, the rhinologist should be on the alert to recognize them and institute the necessary surgical procedures.

3. Anatomical Considerations: As stated before, the nose and paranasal sinuses contain protective mechanisms to prevent infection from reaching the brain. When this barrier is broken the various protective mechanisms of the brain assert themselves. The meningeal barrier, particularly the dural covering, must be passed before the brain tissue itself is attacked (septic emboli excluded). Other protective mechanisms are the compact bony structure of the roof of the orbit, of the ethmoid, sphenoid and inner plate of the frontal sinuses. These plates of bone offer resistance to infection. Cerebral tissue is the most highly specialized tissue in the body. Damage to this tissue is irreparable. It is a known fact that the more highly specialized a cell is the more it depends upon an optimum of oxygen and nutrition for its normal metabolism. The converse is also true, that when such a cell is deprived of nutrition, death results and regeneration takes place.

Eagleton[18] states that vascular paths run from the mucosa of the accessory sinuses through the bone, into the dural plexus, communicating with the veins of the cortex and the longitudinal sinus. Further, an intimate vascular relationship exists between the frontal bone and the dura covering the frontal lobe. It is seen, therefore, how intimately bound up the nutritive vascular supply of the sinuses, bone and dura is.

Penn-Gaskill Skillern, Jr.,[19] states that the frontal lobe receives its nutrition largely from the dura. Zwillinger[20] conducted a fine piece of research where, by injecting colored fluid in the perimeningeal lymph channels he observed it flowing in the lymphatic channels of the frontal sinus mucous membrane. He concluded that the connection between the perimeningeal vessels of the subdural and subarachnoid space with the lymph channels of the frontal sinus is definite and certain.

The intimate blood and lymph supply between the frontal sinus, the bone and dura explains at once how a frontal

sinusitis could lead to an intracranial involvement. On an anatomic basis, the path of infection from a frontal sinus to the brain would be as follows: *a.* by continuity of tissue, *b.* infection along veins—a retrograde thrombophlebitis, *c.* a combination of the two, *d.* by the perivascular lymph spaces, *e.* by infection of the diploeic bone. In this connection, it is well to bear in mind that infection may also pass up the perineural sheaths of the olfactory filaments in the cribriform plate (Key and Retzius). So much for infection.

Trauma: The frontal lobe of the brain, because of its anatomical relationship, is easily traumatized. It is the so-called "silent area" of the brain. It is attached to the dura by minute blood vessels. When trauma is inflicted, these vessels may rupture, producing minute hemorrhages in the pia and arachnoid. Furthermore, the nutritional vascular supply to the frontal lobe is apt to be disturbed, with serious changes in the cerebral tissue. The traumatized brain is also very susceptible to infection. Microorganisms gain a quick foothold in cerebral tissue that has been injured. A certain amount of shock takes place in the brain cells, adding further insult to an already disorganized and devitalized structure. It is probable that an abscess of the frontal lobe, due to trauma over the frontal sinus, will take place because of a combination of infection and trauma. Eagleton[21] says that while the frontal lobe is able to bear trauma well, it is very susceptible to a combination of trauma and infection.

Forcible curettage of the frontal sinus during an operation may break down the resistant barriers and transplant organisms which will ultimately lead to brain abscess.

Finally, in the frontal lobe, only a small collection of pus can occur without involving the vital cells or perforating into the ventricular system. It is seen, therefore, the difficulties that present themselves in the management of frontal lobe abscess and its resistance to treatment.

4. What is Wrong in Our Method of Approach and Methods of Drainage? The rhinologist only has one method of approach and that is to open a frontal lobe abscess by going through an infected area. He cleans out the infected frontal sinus and then follows the path that the pathology has taken from that sinus to the brain in order to provide drainage.

The question as to which branch of surgery, the cranial or the otorhinological, a case of brain abscess should be referred to, arose in the highly instructive neurological conference of Dr. T. H. Weisenburg at the Graduate Hospital of the University of Pennsylvania. Dr. S. R. Skillern, Jr., of the Coates Rhinological Staff, took the stand that where a frontal lobe abscess can be traced to any sinus involvement, the rhinologist should be the man of choice, on the ground that it is necessary to remove the original focus of infection as well as to drain the cerebral abscess resulting from that focus. The same thought applies to the otological service. Dr. Francis C. Grant, Chief of the Neurosurgical Service, Graduate Hospital, concurred with these views. T. H. Weisenburg[22] is of the opinion that any surgery in a frontal lobe abscess should be performed through the infected area.

Regarding the methods of drainage employed, it is interesting to note the divergent opinion of the authorities. King[23, 24, 25] states that in spite of the various forms of drainage materials, none of them adequately drain in the true sense. He feels that the most logical drain is the conical wire mesh drain of Mosher for the reason that the abscess cavity "plasters" itself against the drain and then herniates through the opening in which the drain was inserted, thus effecting the cure. His method is to use no drains at all, but to allow complete herniation of the abscess after making a large cranial defect over the abscess cavity, *i.e.*, unroofing this cavity. The part is Dakinized and strapped, after which epithelization occurs. Of four of his cases, two temporosphenoidal abscesses, one frontal lobe and one abscess due to foreign body, all recovered.

Dandy[26] simply taps the abscess by introducing a ventricular needle, leaving it in place till the pus ceases to drip, when it is withdrawn. Nothing more is done. The cutaneous wound is tightly sewed. Nature eventually absorbs the contents of the abscess and fills the defect with fluid or scar tissue or both. Thus far, he claims reasonably good results following this procedure.

Lemaitre[27] fears the meningeal barrier and urges that the surgeon should respect the preformed adhesions at the subarachnoid space if they are present, or produce adhesions there, *i.e.*, wall off the subarachnoid space, if none exist. The

aim is to seal the subarachnoid space from infection. He performs it as follows: A pravaz needle is pushed through the meninges into the brain at the supposed vicinity of the collection. When a drop of pus escapes, the needle is replaced by a groove director. A drain of very small calibre replaces this. This is left *in situ* 24 to 48 hours. In time this drain acts as a foreign body, irritating the part, creating meningeal adhesions. Larger drains are gently inserted daily or every other day. He has had five cases of cerebral abscess of otitic origin and one frontal lobe abscess, all having recovered.

Cahill[28] stresses the two important points: *a.* avenue of approach, and *b.* method of drainage. He states the more simply this is done the better. The ideal treatment would be to remove the abscess *in toto.* It is dangerous to do so. He discusses the various methods in vogue, but cautions the surgeon to remember to value the protecting meningeal adhesions.

King[29] states that no one procedure will cure all brain abscesses, nor will all combined do so. The method to use depends on the type of case present.

Eagleton[30] prefers an osteoplastic flap. Frazier and Grant[31] have in their recent series 51 cases of brain abscess, of which 21 were frontal lobe abscesses. They have had eight recoveries out of the 21 cases. Their technique is to wait till encapsulation of the abscess has taken place. They found after six weeks from the onset of symptoms all were encapsulated. Rubber drains are very gently inserted and left *in situ* till the brain pushes them out. Politzer[32] called attention to the limiting of infection of meningeal adhesions and that older abscesses are always surrounded by a connective tissue capsule. In the Skillern-Coates[6] series of 27 cases, iodoform gauze dressings were used in seven, rubber drains or tissue in nine, Mosher drain in one and the other ten contained no details of postoperative care. Dr. Coates[33] seems favorably inclined to iodoform gauze drainage, very gently inserted. His aim is to secure good drainage to avoid any trauma to cerebral tissue and to respect meningeal adhesions.

5. *Postoperative Treatment:* Much that might be said here has already been covered in the previous caption. It need only be stated that regardless of what method of drainage is employed, regular systematic attention to the wound with the

least manipulation is of the utmost importance. The patient should be kept at complete rest in bed for a prolonged period and be made most comfortable, using such measures as time has proved efficacious towards getting the patient in the best state of well being. While the postoperative treatment of various authorities may differ in the finer details, their chief methods are designed to aid nature to a speedy return to health.

Ralph Butler[34] reports three cases of frontal sinus suppuration, one following an influenza, the second from trauma over the right frontal sinus and the third of unknown etiology. The first case died on the operating table after the frontal sinus was cleaned out thoroughly and while sutures were being applied. The second case, giving a history of having been kicked by a horse over the right eye 14 years before admission to the hospital, recovered from the radical frontal sinus operation, but had to have a gold tube inserted. Four years later, patient returned suffering with an acute suppuration of the right frontal sinus with granulations around the gold tube, which was still *in situ*. This cleared up with a few treatments. Four years later there was a recurrence of the acute symptoms, but the patient refused to go to a hospital and died a month later. The third case showed a frontal sinus filled with pus, the posterior wall necrosed over an area of 1 cm. in diameter through which an inflamed dura was seen to be pulsating. Patient did badly on the operating table and died three days later.

The purpose of reporting these case is best explained by quoting Dr. Butler verbatim: "There is no more important phase of rhinology and none worthy of more serious thought and study than that of inflammation of the accessory sinuses and their serious complications. Because of our insufficient knowledge, it is advisable to report our successes and still more so our failures so that evidence may be at hand for the drawing of correct conclusions in regard to the prevention and cure of dangerous complications."

It is with this spirit that the writer will now present the case report: W. B., male, age 11 years, admitted to the Otorhinologic Service of Dr. George M. Coates at the Graduate Hospital, University of Pennsylvania, on Nov. 1, 1931, with the complaint of severe and constant pains in the head. The

family history is of no importance. Three years previous to admission the child was hit over the right frontal sinus region with a baseball bat. He did not lose consciousness and the laceration was sutured by his physician. Three months previous to admission, he complained of sharp pain in the head, following which a swelling of the right eye and forehead took place. This was incised by a rhinologist with resultant improvement. Two months before admission headaches recurred with some vomiting. Refractive error was corrected, no improvement. One month before admission was given some medicine for stomach and liver trouble with a decided improvement. One week before admission there recurred severe and constant pains in the head and vomiting. No history of chills could be elicited. X-ray taken at Maple Ave. Hospital, Dubois, Pa., revealed "abscess over the right eye, near the brain." He was referred by Dr. Beals to Dr. Coates. Physical examination: Temperature 98.8°, pulse 110, respiration 20. Well nourished, thin, scalp negative, teeth in bad condition, no cervical adenopathy, lung expansion good, lungs clear, heart sounds regular and tone good, abdomen negative, extremities negative, normal reflexes. Dr. Coates found the ears normal, tonsils buried, and septum deviated high to the right, crowding out the right middle meatus. Right middle turbinate jammed. Orders were written for further temperature studies, blood, urine, neurologic, eye, Barany refers and X-rays.

The findings from the day of admission (Nov. 1) until Nov. 6, 1931, were as follows: Temperature averaged 100° and pulse was commensurate, except on the first day the temperature at 4 P. M. rose to 100.4°, the pulse fell to 64 (Macewen's sign).

Neurological examination, by Dr. Joseph C. Yaskin, at this time was entirely negative. The eye report by Drs. L. C. Peter and E. B. Spaeth is as follows: A bilateral infiltrated edematous swollen nerve head in each eye, a papillitis with edema rather than a papilloedema. Visual fields show concentric contraction.

Urine was negative. R.B.C., 3,960,000; Hb., 67 per cent; W.B.C., 11,500; 78 per cent, polys; 1 per cent, eosinophiles; 1 per cent, monocytes; 29 per cent, lymphocytes; 1 per cent, basophiles.

Barany examination by Dr. B. H. Shuster, of the Coates' Otologic Staff, was as follows: *1.* Poor pelvic girdle movements. *2.* Persistent past pointing with the left arm considerably longer duration than the right. *3.* No shock responses, no sweats, nausea or discomfort following a complete test. *4.* Exaggerated nystagmus responses to rotation, 30° when turned to the right and 40° when turned to the left.

X-ray (Drs. G. E. Pfahler and J. G. Cohen): An old suppurative right frontal sinus with erosion of both the anterior and posterior walls, also the anterior portion of the floor of the sinus. A rational opinion of epidural abscess must be considered. Ethmoids and maxillarys show thickening of mucous membrane. The child complained of headache almost continuously, but not severe. He vomited sometimes.

Operation: Nov. 6, 1931.

Intranasal: Right middle turbinectomy, removal of ethmoidal cells and rasping of the nasofrontal duct. A bilateral Skillern operation was performed. The right sinus found small posterior wall necrotic with the dura exposed on removal of necrotic bone. Communication was established between the right and left frontal sinuses. The left frontal sinus contained some hyperplastic tissue with polyps in the upper part. Left nasofrontal duct undisturbed. On the right side, the outer and inner plate of the frontal bone was removed, about two square inches in extent. Dural exposure showed a yellowish, necrotic looking spot one inch to the right of the midline and one-half inch from the floor of the anterior fossa. Dura was under tension, especially near the midline. Cofferdam was made of iodoform gauze and inserted at the edges of bone surrounding exposed dura and wound dressed with two sutures, leaving the right side practically open. The following day, Nov. 2, 1931, the patient was again taken to the operating room, dressings removed, skin flap elevated. Cofferdam was removed and wound irrigated with 1/5000 bichloride solution. Tension of dura appeared to be increased, particularly near the midline. Surface of the dura was painted with iodine and incision with a sharp knife made on the yellowish spot previously noted. There was no subdural abscess. A brain cannula was then inserted to the extent of one inch and much resistance encountered, apparently there being a capsule present. Cannula could not be inserted into capsule

until after a sharp, long bistoury was used and incision made into the capsule. One dram of pus was recovered from the abscess cavity. The tension towards the midline still persisted and another incision and tap was made in the tense area from which about four drams of pus under tension was obtained. This was much more superficial, about three-quarters of an inch deep. The incisions between the two tappings were enlarged so that they became one. Both parts of the cavity were well packed with iodoform gauze and a skin flap left fairly wide open. The left frontal sinus was completely covered over and skin flaps sewed together. Pus from brain: Staphlococcus albus in pure culture.

Postoperative Notes: Nov. 8, 1931: Patient's condition was very satisfactory. Maximum pulse 96, temperature 100°. Brighter mentally than before operation. Slight droop to left angle of mouth.

Nov. 9: Clear mentally, takes liquids by mouth. Temperature 101°, pulse 120.

Nov. 10: General condition good, much brighter mentally. Wound dressed by Dr. Coates. All sutures removed. The drain at the left end of wound was removed. Also the Cofferdam drain packed between dura and skull.

Nov. 12: Wound redressed, alcohol-mercurochrome dressings. Child in good condition. Temperature 98.2°, pulse 85, respiration 20.

Nov. 13: Iodoform packing completely removed and new one inserted by Dr. Coates. Child had considerable headache today and does not look so good.

Neurologic Examination: Nov. 13 (Dr. Yaskin): Severe headache in the frontal and occipital region, which is becoming progressively severer. Operation having been performed on Nov. 6, the exacerbation of symptoms has taken place one week later, Nov. 13. Child is bright and lucid, and answers questions intelligently and accurately. Bilateral Kernig present. Cranial nerves are negative except for weakness of the left lower face. No pathological reflexes. Synergic control normal. The opinion expressed was that a localized meningitis, poor drainage or extensions of process has taken place. Visual fields were reordered.

Eye Report (Drs. Peter and Spaeth) Nov. 14: This case kept under daily observation. There has been a definite and sudden increase in the papillitis. Considerable hemorrhage on each nerve head. The papillitis has swung to a definite papilloedema of over four diopters. It seems that the papilloedema, which has now appeared, indicates a definite increase in intracranial pressure. Visual fields were irregular, with flattening of the upper limits. Temporal field of O. D. more narrowed than the temporal field of O. S.

Nov. 16: Temperature began to rise somewhat and pulse dipped. Pulse ran around 62, temperature 101°. Blood transfusion: 200 cc. blood, 20 cc. citrate, normal saline 50 cc.

Neurological Examination: (Dr. Joseph Yaskin) Nov. 17: Child somewhat brighter. Pulse 64. Neck more resistant.

Nov. 18: Condition is unchanged. Positive Babinski right side. Slight weakness of left arm and leg. There is still evidence of meningeal irritation.

Progress Notes: Nov. 19, 2:30 A. M.: Irregular pulse 84, axillary temperature 101.6°. Child vomiting. Incontinence of urine and feces for first time. Slight Babinski right foot. 4:30 A. M.: Patient had convulsion. Opisthotonous for two minutes. Twitching of right eye and lower lip bitten. Patient listless when spoken to. Remains incontinent. Temperature began to mount from 100° to 101°, then to 102.8°, 103°, pulse remaining between 72 and 90. At 10 A. M., temperature went up to 106° and pulse 160. At 11:30 A. M., temperature was 108° and pulse 170. Respiration 48.

The child was rushed to the operating room. Dressings were removed. A large mass of strangulated and necrotic brain tissue about three inches in diameter was seen protruding from the previously operated wound. Considerable capillary hemorrhage was noted around the wound. The mass was removed by means of scissors and scalpel flush with the cranial wound. It was found to contain an abscess capsule about one inch in diameter with thin pus that apparently had been protruded with the hernia. From the original deep abscess cavity in the external side of the frontal lobe, clear fluid dripped. This was presumably cerebrospinal fluid and suggested rupture into the lateral ventricle, probably during the convulsions that produced the brain hernia. After the removal of the mass, gauze packing was placed in various crevices,

also a rubber tube into the original abscess cavity. Sterilized vaseline gauze was applied to the surface, the drainage tube and gauze being permitted to protrude through it. Three skin sutures were lightly applied to keep tissues as well as gauze in place. Child was given glucose and saline intravenously.

Terminal Course: On Nov. 18 and 19, the pulse dipped down to between 60 and 64. At the same time temperature began to mount (103°).

Following the convulsion (Nov. 19, at 4:30 A. M.), the temperature mounted rapidly to 106°, 106.4°, 108° and pulse very rapid and irregular, running between 160 and 178. Respiration went to 48, and at 8:40 P. M., Nov. 19, respiration ceased.

Necropsy by Dr. L. Tuft: Cavity in brain is so large that finger enters the lateral ventricle. Dura was neither thickened or congested. Pia is injected, but no evidence of meningitis is seen over the upper surface nor on the under surface of the brain in contact with the frontal region. On removing the brain, frontal lobe of right side is extremely soft and mushy. On opening tentorium cerebelli to remove cerebellum a large quantity of pure yellowish white pus found bathing the entire outer surface of the cerebellum and extending down over the posterior aspect of the brain stem. Cerebellum, pons and medulla are very soft and friable. No pus or exudate in the ethmoids and sphenoids.

Brain Preserved in Formalin: External examination of the lobes and surface of cerebrum show no evidence of exudate or inflammation, but on the upper surface there is considerable injection of capillaries and vessels. Right frontal is entirely macerated at its tip, the whole anterior portion being necrotic and the interior hollowed out; the cavity thus formed is ragged and irregular, and extends into the right lateral ventricle. Basillar pia showed no distinct purulent exudate. On section, the right lateral ventricular wall is very macerated. Left side the cavity is small and intact. The choroid plexus are thickened and intensely injected. External surface of cerebellum is roughened, but section of cerebellum is negative. Medulla and pons show no gross changes. Section taken from choroid plexus shows passive congestion into postmortem degeneration.

Gross Pathologic Diagnosis: 1. Operative wound of right frontal bone extending into frontal lobe of brain. *2.* Abscess of frontal lobe extending into right lateral ventricle. *3.* Acute congestion of pia arachnoid. *4.* Subtentorial abscess. *5.* Petechial hemorrhages of cerebrum. *6.* Acute inflammation of choroid plexus.

COMMENT.

This case presented old trauma as an etiological factor. It was the severe headaches and occasional vomiting that aroused in the mind of the referring physician the probability of cerebral involvement. As the case was thoroughly studied, it was observed that the headaches were most severe and were not controlled by any medicament. The headache became progressively worse. Four distinct Macewen's signs were noted, one on the first day, one on the fifth day, one on the seventeenth day and one on the eighteenth day. Another feature of this case was that it showed at least two abscesses. This is interesting, because multiple abscess is comparatively rare, particularly in the frontal lobe.

The eye reports showed at first a papillitis with edema, which later gave way to a marked papilloedema. The visual fields showed irregularly, indentations with considerable narrowing, right eye being affected more than left eye.

L. C. Peter[35] states that a papillitis is an inflammation of the nerve head, due to some toxic focus, while a papilloedema is essentially a swelling due to mechanical pressure effects. Furthermore, any impingement along the visual pathway from the chiasm on back may show marked localizing perimetic changes, either direct or indirect.

The neurologic finding showed the cerebration of the child to be perfectly normal almost to the very end. Except for some weakness of the left corner of the mouth, left hand and foot, with a right Babinski, the findings were almost negative.

The Barany findings were very important. Summarizing the localizing factors in this case, Dr. B. H. Shuster[36, 37, 38] has this to say: Neurologically—the left hand did not respond with as much readiness to motor stimuli as the right, indicating a motor weakness, *e.g.*, when asked to point to his nose with the forefinger, the right one responded rapidly and accurately,

but the left hand, while it did not show any incoordination, dragged slowly to the nose in pointing. Persistent pastpointing with the left hand indicated an impairment in inhibition of the motor area on the right side. Poor pelvic girdle resistance in the absence of cerebellar signs would suggest a motor impairment, a lesion in the vicinity of the motor tract, this coupled with the left hand involvement would point to a lesion near the right frontal motor area.

The ability to get response through the eighth nerve and cerebellum (the presence of reactions as well as no interception of vertigo and pointing responses) would preclude a possible lesion in the posterior fossa. The history of frontal sinusitis and trauma on the right side would tend to confirm the above data.

Thus far it is seen that the diagnosis of this case was established in a most direct manner, with no loss of time.

The operative attack was performed through an infected area, cleaning out the focus of infection and respecting preformed adhesions deeper in. Drainage of the cerebral abscess was effected with the least trauma. Iodoform gauze drainage was used, because experience has proved the value of it in past cases in the Coates Otorhinologic Service.

The child was progressing favorably after the operation and only on the day he died did he show sudden marked change for the worse. When the rupture of the drainage abscess took place in the right lateral ventricle, following the convulsion, and when the cavity herniated, temperature, pulse and respiration rose very high, consciousness was lost and the vital centers were paralyzed by the overwhelming infection in the ventricular system.

CONCLUSIONS.

In correlating this case report with the original premises set forth in the beginning of the paper, it is seen that the death of this child could not be ascribed to mismanagement at any time. Dandy[26] well said that if nature cannot wall off an intracranial infection and transform an acute abscess into a chronic abscess, the condition is hopeless. The cerebral tissue in this case undoubtedly suffered such nutritional death that its protective mechanism no longer could resist further

ingress of infection. The motor centers were so irritated by the infectious processes that convulsions occurred. The terrific strain induced by the convulsions caused rupture of the abscess cavity into the ventricular system. The death was probably due to paralysis of the vital centers on the floor of the fourth ventricle, the associated cerebritis and meningitis.

In conclusion, I want to thank my distinguished Chief, Dr. George M. Coates, for the privilege of assisting in this case as well as presenting it before this audience.

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LATERAL SINUS THROMBOSIS. REPORT OF CASE.*

DR. LEROY E. WIBLE, Pittsburgh, and
DR. HERMAN B. SLOTKIN, Philadelphia.

In 1880, Zaufal[1] described for the first time the treatment of evacuating the sinus and tying the jugular vein, although he did not perform the operation until four years later. In 1898, Viereck[2] published his monograph reviewing the subject and found reports of 170 cases in which operation had been performed; these included both those in which the jugular vein was ligated and those in which it was not ligated. This condition was recognized and cases were reported, however, many years before any operation was done for its relief.

Symptoms in septic sinus thrombosis vary more, probably, than in any other condition we are called upon to meet. Rigid rules can scarcely be followed in the management of these cases and the otologist in the course of his practice solves each case on its own merits. Our case presented a number of problems which seem to us of sufficient interest to warrant this report.

R. B., female, age 6 years, was admitted to the pediatric service of Dr. H. C. Carpenter at the Graduate Hospital of the University of Pennsylvania, May 11, 1933, with a chief complaint of swollen glands in the neck. The history revealed that three weeks before admission the patient had been thrown against an automobile windshield, sustaining contusions and slight lacerations of the right side of the face and ecchymosis about the right eye. There was no bleeding from the ears, nose or throat at this time, and consciousness was not lost. For two weeks following the accident no complaints were registered and then pain in the left ear and swelling of the left side of the neck appeared. A left myringotomy, performed by the family physician on May 10, 1933, was reported to have been followed by a discharge of thick pus.

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*From the Otorhinologic Service of Dr. George M. Coates, Graduate Hospital of the University of Pennsylvania.

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On admission the child appeared toxic, breathing was somewhat labored and pulmonary signs pointed to an infiltration at the left base. Roentgen examination of the chest revealed a marked generalized bronchitis and suggested a developing pleuritis or pneumonia. The temperature was 101° F., the pulse 124 and the respirations 26. Otologic examination revealed a congested and thickened drumhead with a slit-like central perforation; dried blood was noted in the external canal. Some tenderness could be elicited over the mastoid tip on the left side. The right ear presented a normal appearance. There was a bilateral cervical adenopathy, more marked on the left side. The tonsils and adenoids had been removed.

Examination of the blood revealed a red cell count of 4,020,000, a hemoglobin percentage of 67, a leukocytosis of 23,800 and 83 per cent polymorphonuclear cells. The urine showed no abnormal findings. Roentgenograms on May 12 showed the right mastoid region to be normal. The left mastoid process was normally developed, with some haziness more or less uniformly distributed throughout; the cell walls were intact. No other roentgenographic changes were visible. The findings suggested the presence of an acute, reactive catarrhal mastoiditis. Examination of the base of the skull revealed no evidence of fracture. A subsequent study revealed no variation in the size of the jugular foramina and the lateral sinuses on the two sides. No pneumatization of the petrous pyramids could be made out.

Blood culture report on May 16 was positive for streptococcus hemolyticus in pure culture. Examination by the eye service of Dr. L. C. Peter the following day revealed no disturbance in ocular motility, but through dilated pupils a bilateral papilloedema of about 3D was noted.

The daily fluctuation in the temperature was now between 100 and 103.5° F., the pulse ranged between 100 and 130, and the respirations remained below 30. Blood pressure readings averaged 65/35. The red blood cell count dropped to 3,610,000, hemoglobin percentage was 63, and the leukocyte count dropped to 16,100, with a polymorphonuclear percentage of 79. A spinal tap showed clear fluid under normal pressure, six cells per cmm., sugar positive, protein negative, and a colloidal gold reaction of 000 000 000 0. Culture showed no growth.

On the eighth day following admission, pain appeared in the left ankle. The left ear began to discharge. A transfusion of 250 cc. of blood was given. Examination by Dr. George M. Coates, on May 20, showed the ear to be dry and there were no objective signs of mastoid infection or of involvement of the lateral sinus. A Tobey-Ayer test was recommended. The child was given 180 cc. of a nonspecific immuno transfusion.

On May 21, an abscess which had developed in the left ankle was incised and drained. Smears from the pus obtained showed streptococci in short chains, staphylococci and pus cells.

The Tobey-Ayer test was reported as negative on May 23, the pressure of the cerebrospinal fluid being raised equally when the right and left jugular veins were compressed in turn. The original spinal pressure was 8 mm. of mercury, which rose to 18 mm. upon jugular compression. A blood transfusion of 200 cc. was given.

May 24 found the daily temperature readings fluctuating between 98 and 105° F., the pulse between 118 and 150, and the respirations between 24 and 38. Roentgen study of the bones of the left ankle revealed no evidence of pathology. A vaccine was prepared from the blood culture. The red cell count on May 25 was 4,470,000, hemoglobin concentration 72 per cent, white cell count 16,800, and polymorphonuclear percentage 74. There was no shift to the left. Urinalysis was negative. Another blood transfusion of 200 cc. was given.

The child showed considerable wasting and was rapidly losing ground. The pediatric service felt that although the breath sounds were harsh at the lung bases posteriorly, surgical intervention would not be contraindicated.

The child was brough to operation May 26, with a preoperative diagnosis of suspected lateral sinus thrombosis. A simple mastoidectomy was first performed. The bone was found to be quite hemorrhagic. The dura over the tegmen antri was uncovered and found to be normal. The bony plate over the sigmoid sinus was removed in part, revealing a mildly injected lateral sinus wall which seemed of almost normal pliability. An aspirating needle, however, showed the sinus contents to be chiefly thick pus which was drawn into the syringe only by the use of considerable force. After packing

between the sinus and the bony plate, at about the knee of the sinus, the latter was incised, releasing a considerable amount of pure pus. Upon relieving the pressure on the pack, a moderate amount of bleeding occurred from the upper part of the incision. The pack was replaced. There was no bleeding from the bulb end of the sinus even with mild suction. This lower end of the sinus was then packed with iodoform gauze, to which a black silk ligature was attached, its free end extending out through the wound. One piece of iodoform gauze was placed in the mastoid cavity.

The internal jugular vein was ligated opposite the hyoid bone, apparently above the common facial vein. An iodoform gauze drain was inserted in the wound.

The patient's immediate postoperative condition was good. She received 250 cc. of Hartman's solution intravenously. The following day the drainage gauze was removed from the bulb end of the lateral sinus. Practically no bleeding followed. The appearance of the wound was good and the patient's general condition seemed improved. A blood transfusion of 250 cc. was given on May 29. Examination of the blood now showed a red cell count of 4,510,000, a leukocytosis of 22,000, with 86 per cent polymorphonuclear cells, and 69 per cent hemoglobin.

Cultures taken from the lateral sinus and mastoid areas at the time of operation showed streptococcus hemolyticus and nonhemolytic staphylococcus albus. Temperature fluctuations now remained under 102° F., the pulse did not exceed 120, and the respirations averaged 28.

On June 1, a swelling was noted at the right sternoclavicular joint. A purulent discharge continued from the left ear. The mastoid drain was shortened. The following day the temperature was normal and there was evident improvement, the papilloedema of the right eye having receded to almost normal, while on the left side it was about 2D.

On June 3, the iodoform gauze pack compressing the upper end of the sigmoid sinus was removed; no bleeding followed. The cervical drain was discontinued. The red cells now numbered 4,790,000, the hemoglobin remained at 69 per cent, leukocytes were 13,800, polymorphonuclears 78 per cent, lymphocytes 19 per cent, and mononuclear cells 3 per cent.

Blood culture taken at this time showed no growth. The fluctuating mass at the right sternoclavicular joint was still present on June 5 but was receding. The discharge from the left ear had diminished. The ocular fundi continued to show daily improvement.

By June 12, the red cell count had risen to 4,860,000, the hemoglobin to 72 per cent, and the lymphocytes to 39 per cent.

The patient was discharged on June 24, 1933. She has been seen since this time and is fully recovered.

COMMENT.

This case illustrates the problem of a masked sinus thrombosis in the presence of a complicating pneumonitis. When surgical intervention was finally resorted to, the true state of affairs was disclosed only when an aspirating needle in the lateral sinus drew forth pus. Thrombosis was present despite the fact that the tunica adventitia presented a normal appearance.

An early diagnosis is of paramount importance. The Tobey-Ayer test was of no value in this case and may be misleading.

Headache was never registered here as a complaint. Papilloedema, which was present, is seen more frequently with sinus thrombophlebitis than with either cerebellar or temporosphenoidal lobe abscesses.

Metastatic arthritides were present in this case and were represented by a subcutaneous abscess of the ankle, and, later, by an arthritis of the sternoclavicular joint. The sternoclavicular is the most frequently involved joint with lateral sinus thrombophlebitis. It rarely suppurates and has been referred to as a toxic arthritis.

Kopetzky[3] and others have called attention to this insidious, so-called painless type of mastoiditis and its potential danger. This is not the type of mastoid disease generally met with in children.

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A YEAR'S WORK WITH IONIZATION IN THE TREATMENT OF HAY-FEVER.*

DR. ARTHUR M. ALDEN, St. Louis.

My experience with ionization in the treatment of hay-fever began the first week in September, 1933, when Dr. Warwick was kind enough to come to St. Louis and demonstrate this procedure to me. The results in the demonstration cases were so prompt and satisfactory that I decided to investigate this treatment more thoroughly on a group of my own cases.

During the 1933 season I ionized 19 cases of typical autumnal hay-fever. One of these patients was a child 10 years old, in her third season of the disease. The others were all adults between 22 and 58 years of age. Most of them were in the age period between 30 and 50 years. All of these cases were ionized during the period when the symptoms of the disease were definitely manifest, and four of the adults also had asthma at time of the ionization. Eleven of these patients had previously been treated by desensitization, but with unsatisfactory results. Five had received only local treatment, and three, including the child, had received no treatment of any sort.

The results of the ionization in this group was immediate and complete relief in each case of all allergic symptoms for the remainder of the season. The promptness with which the eye symptoms and the nasal itching abated following the treatment was indeed spectacular. In all of these cases the nose was entirely blocked with a membrane the day following the ionization. This membrane remained in place for three to four days, then began to loosen and was, as a rule, entirely gone by the end of the sixth day. Immediately following the expulsion of the membrane, the nasal mucosa was found to be reddened and quite sensitive, but this condition subsided very rapidly and by the end of the second week, all noses

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appeared to be normal. The only postoperative medication used was a solution of ephedrin in oil, which was given to be used as nasal drops by the patient after the membrane had been expelled.

The majority of this group of cases have been followed closely since last hay-fever season and in not one of them has there been any clinical evidence of damage to the function of the nose.

Naturally, we watched this group of patients with great interest when the hay-fever season started again this year. Two of them began at once with very typical symptoms, differing little from previous years. Both of these persons were promptly reionized and are entirely comfortable at the present time. Six others had slight symptoms at the beginning of the season, but their attack this year has been so mild that another ionization was not advised. Two others began their symptoms two weeks after the season had started in St. Louis, but each of these has had so little discomfort that it has been easily controlled by local treatment. Nine of last year's cases have been entirely without symptoms up to the present time.

Prior to Aug. 15 of this year, 41 cases, each with a definite history of autumnal hay-fever, were ionized with the hope that they would be protected when the pollen season began. Two of these were children 6 years old. Two were 72 and 77 years old, respectively, four were between 60 and 70 years, and the remainder were principally in the age group between 30 and 50 years.

The time elapsing between the ionization of the patients in this group and Aug. 15 is as follows:

Eight months, one; six months, one; four months, two; three months, five; two months, nine, and the remaining 23 were done in the period between July 15 and Aug. 15. Of this group, 15 patients have shown definite symptoms, varying from a typical attack with asthma down to slight sneezing and mild conjunctival irritation. Six have not reported and the remainder are entirely comfortable. Of the failures, six were in the group done in the month prior to Aug. 15, eight done two months prior, and one in the three months period. Curiously enough, the four patients who were ionized eight months, six months and four months, respectively, before Aug. 15 were all completely protected.

Nine of the failures have been reionized with complete relief in all but two. These two cases in spite of reionization and local treatment are still having definite symptoms. Two of the remaining six who were having trouble refused the reionization and the other four were having so little discomfort that retreatment was not advised.

In this, as in all cases of experimental therapy, the failures are more interesting and instructive than are the successes. It would appear that the age of the patient and duration of the symptoms prior to the ionization have little to do with the success or failure of the treatment. One of the most outstanding successes was in a patient 66 years old, who had had hay-fever, complicated with a very severe allergic conjunctivitis and who was ionized twice eight months prior to the beginning of the hay-fever season. Another was a patient 77 years of age, who had had hay-fever for more than half a century and who was ionized four months before Aug. 15. This patient has also been entirely relieved of all allergic symptoms. It is perhaps noteworthy that of nine patients done between the period of June 15 and July 15, eight of them had a return of symptoms; whereas, of nine patients done in the period from three to eight months prior to the beginning of the season, only one showed any symptoms this year. Of the 23 ionizations that were done before July 15 and Aug. 15, six, or about 25 per cent, had definite hay-fever after the season began. Certainly, no definite conclusions can be drawn from the above statistics.

At the present time an investigation of a group of clinic patients with hay-fever is being carried out at Barnes Hospital. This work is under the direction of Dr. Harry Alexander and myself. These patients are being studied from an immunological and cytological standpoint, both before and after ionization, and a detailed report of this work will appear in a later paper.

A theoretical criticism of this treatment based upon the possibility of permanent damage to nasal mucous membrane as the result of ionization has been made by many individuals. I now have sections of middle turbinates removed from a group of patients who have been ionized from one to seven months previous to the biopsy and without exception these

specimens show intact and normal mucosa. Microphotographic reproductions of these sections with descriptions will appear in a later publication.

In all of this work the standard apparatus and technique, as originally devised by Dr. Warwick, has been used.

CONCLUSIONS.

1. Nasal ionization following the technique elaborated by Warwick when given after the hay-fever symptoms have started apparently stops the disease in the majority of patients for the remainder of the season.

2. About 50 per cent of these patients are free of symptoms during the second season.

3. When the treatment is given prior to the beginning of the pollen season, about half of the patients appear to be completely protected.

4. Clinical observation and microscopical examination of nasal tissue has thus far shown no evidence of permanent nasal damage following ionization.

Frisco Building.

MIXED TUMOR OF THE PHARYNX. CASE REPORT.*†

DR. JO ONO, Philadelphia.

The so-called mixed tumors of the pharynx are always of interest to laryngologists because of the site in which these tumors occur and because by virtue of their slow and insidious growth they may be undetected for years and are often discovered accidentally on the routine examination of the oropharynx. They are of interest also because there seems to be a controversy among the eminent pathologists as to whether this peculiar type of tumors be grouped with the malignant or the benign and, if malignant, whether they are carcinomatous, sarcomatous or endotheliomatous. The following case report of such a type of tumor is presented because of its unusual location and because of the conspicuous absence of symptoms during the entire period of its existence.

Case Report: J. F., age 28 years, white male, was admitted to the service of Dr. Louis H. Clerf, Jefferson Hospital, Feb. 9, 1933. His chief complaints were a lump in the throat and slight thickness of speech. The family and personal history were essentially negative. The onset of the present illness began seven years previous to admission, when the patient suddenly felt a lump in the throat. No attention was paid to it since there was no pain, discomfort or difficulty with swallowing. The patient was insistent that the onset was sudden and that there had been no change in the size of the mass for the past seven years. Recently, fearing that this mass might turn into something of a more serious nature, the patient sought medical advice.

On admission, the patient was comfortable and appeared to be in good physical condition. There was just a suggestion of thickness of speech. Findings of the ears, eyes and nose were negative. In the pharynx, there was found a large smooth mass, size of a small orange, occupying the greater

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†From the Bronchoscopic Clinic, Jefferson Hospital, Philadelphia.
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part of the pharynx. It appeared to have sprung from the right pharyngeal wall, extending laterally against the ramus of the mandible. The base of the tongue was crowded forward particularly on the right side, and the uvula and right tonsil were displaced to such an extent that they were in contact with the left tonsil. No aperture could be made out leading to the pharynx without the aid of a retractor. The mass was smooth, firm and fixed. There was no tenderness, fluctuation or pulsation noted. The overlying mucosa was devoid of ulceration or inflammatory reaction. Indirect laryngoscopy could not be carried out on account of the tumor. There was a rather marked prominence over the right submaxillary region. By bimanual palpation this proved to be the mass continuous with that in the pharynx. The larynx was displaced to the left. No palpable lymph nodes were noted over the neck. Examinations of the thorax, abdomen and extremities were normal.

On Roentgen study it was found that the right half of the mandible was normal and was in no way connected with the mass. The blood was negative for both Wassermann and Kahn reactions. The ordinary and differential blood counts were normal. With the view of maintaining a sufficient airway during the operation for removal of the growth, a preliminary tracheotomy was done under local anesthesia. Later, under avertin ether anesthesia, operation for removal of the growth was carried out by Dr. Clerf. The growth was explored and found to conform fairly accurately with the previously made observations. It seemed to fit very snugly in the right pharynx extending to the hard palate above, against the ramus of the jaw on the right, in contact with the left tonsil on the left, the right tonsil having been crowded over to the left side of the throat, to the spine posteriorly and crowding the base of the tongue forward anteriorly.

A vertical incision was made parallel with and external to the right faucial pillar. It was found that the growth could be readily separated from the surrounding tissues. Difficulty was encountered, however, along the ramus of the jaw, along the hard palate and posterior pharyngeal wall because of intimate contact with bony walls, including the cervical vertebrae. In order to gain free access to the lower pole, a segment of the upper part of the growth had to be removed

by cutting the growth itself. Practically no bleeding was encountered. The growth was finally delivered and found to measure 7 x 7 x 5 cm. and weighed 105 gm. (see Fig. 1). It was very firm, although in its central portion there was some tendency toward softening. The cavity was packed with iodoform gauze and the edges of the wound approximated with catgut. It was of interest to note that there was no definite pedicle and it could not be ascertained where the growth originated except that it was contained in the soft tissues

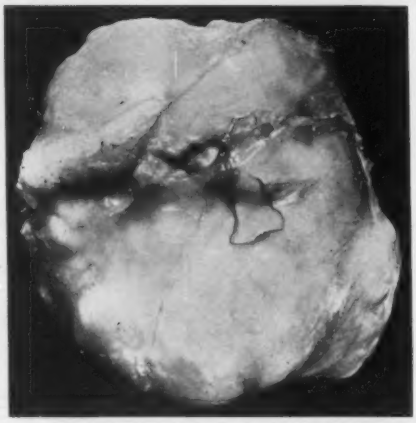

Fig. 1. Photograph of mixed tumor removed from pharynx of patient, age 28 years. The tumor measured 7 x 7 x 5 cm. and weighed 105 gm. The surface was quite smooth and the growth was sharply limited by a capsule.

of the right side of the oropharyngolarynx. The histological examination of the tissue specimen from the tumor revealed that it was composed of a variety of structures, with much gland tissue, cartilage, fibrous tissue and small areas of myxomatous tissue. The mass had a definite fibrous capsule. A diagnosis of mixed tumor of the pharynx was made by Dr. B. L. Crawford. Feeding was carried out via a nasal feeding tube. Although there was considerable swelling of the right side of the neck for several days, the patient made a very satisfactory recovery from the operation. The cavity was promptly obliterated, the wound healed satisfactorily and the patient was discharged on the twelfth day after operation. To date there has been no recurrence of the growth.

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METASTATIC HYPERNEPHROMA OF THE TONSIL.

Dr. L. C. Menger, Brooklyn, and
Dr. Isidore Arons, New York.

That the laryngologist should never be hasty in making a diagnosis in an ulcerative lesion of the throat is well borne out in the case about to be reported.

A male, age 67 years, weighing about 255 lbs., was first seen in the out-patient department of the Bushwick Hospital on April 29, 1934, where he applied for treatment for a recurring sore throat which had been bothering him for the past three weeks following the extraction of two teeth under local anesthesia. He gave the following history: On Nov. 17, 1930, he was admitted to the Urological Service of the Presbyterian Hospital, New York City, where he had a suprapubic prostatectomy. He was discharged Dec. 8, 1930. On April 1, 1932, he was readmitted to the same institution because of a hematuria which had been lasting three days. Right and left Ureterograms and Pyelograms were taken and a diagnosis of tumor of the left kidney made. On April 4, he submitted to a left nephrectomy. Postoperative pathological diagnosis was a hypernephroma, left kidney. With this diagnosis came a note from the pathologist of the hospital, stating as follows: "Careful follow-up for a metastasis (lung?) is important. While the tumor at the level sectioned does not seem to have passed the endothelial barrier of the vein, one cannot be sure that this has not occurred at another point." He was discharged from the hospital on April 17, 1932. The rest of his history was of no great significance and is therefore omitted.

Physical examination of throat. There was an ulceromembranous area on the cryptic surface of the right tonsil very suggestive of a Vincent's angina. A smear taken from this region showed the specific organisms in fairly large numbers. The blood count taken at the same time was as follows: R. B. C., 5,140,000; W. B. C., 9,350; hemoglobin, 95 per cent; color index, .93; Differential—neutral polys., 74 per cent;

eosinophiles, 0; basophiles, 0; lymphocytes, 18 per cent; monocytes, 8 per cent. The Wassermann blood reaction was negative.

The patient was given local treatment for what was interpreted to be a Vincent's. Two weeks later he was again seen by one of us (L. C. M.) and there was a very decided change in the local condition. The right tonsil showed a very profuse growth of tissue from the cryptic surface of the same, re-

Fig. 1. Involved right tonsil, proven microscopically to be a hypernephroma. Before irradiation

sembling granulation tissue. This was dark red in color and was just about as large as the tonsil. This mass was easily and completely removed from the tonsil with a tenaculum and a snare. It was sent to the Pathological Laboratory for examination and later reported on as follows: "Specimen consists of a piece of tissue about the size of a hazel nut, supposedly removed from the tonsil. It is discolored by superficial hemorrhages and is friable in consistency. On section there appears to be an outer discolored portion and an inner,

whitish center. Microscopical diagnosis by Dr. Jacob Werne: Section is lined by stratified epithelium which is in part ulcerated by pressure of a growth underneath. The tumor is made up of irregular sheets of foamy cells with vacuolated cytoplasm and small, pale staining nuclei. Separating the cell groups are thin fibrous septa with very thin walled blood vessels. There is considerable hemorrhage throughout. Diagnosis: Hypernephroma, metastatic to the pharynx."

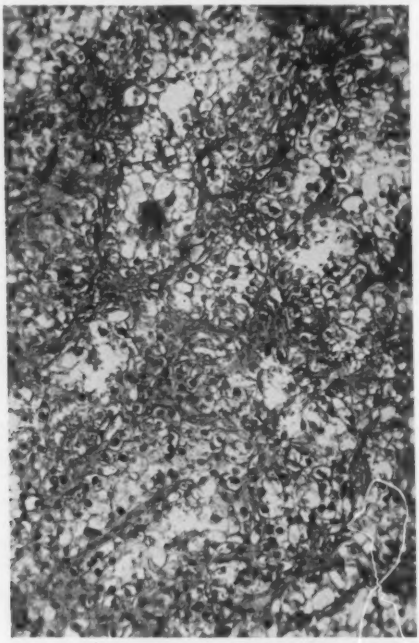

Fig. 2. Low power. Characteristic hypernephroma. Slender fibrous strands bearing capillaries with solidly packed pale cells between them.

Dr. I. Arons, of New York, was consulted and it was decided to treat the patient by means of radiotherapy. The Coutard technique was employed.

The Coutard technique attempts to increase the difference in radiosensitivity of the carcinoma and surrounding tissue. An erythema of the skin will not develop when the dose is

given in fractions on successive days, which constitutes the fundamental principle of the Coutard technique as the tolerance of the connective tissue and the vascular system is considerably increased by such a division of dosage. The cutaneous dose recommended is from 5,000r to 7,000r* over a period of 20 to 40 days, the daily dose not exceeding 100r to 200r per

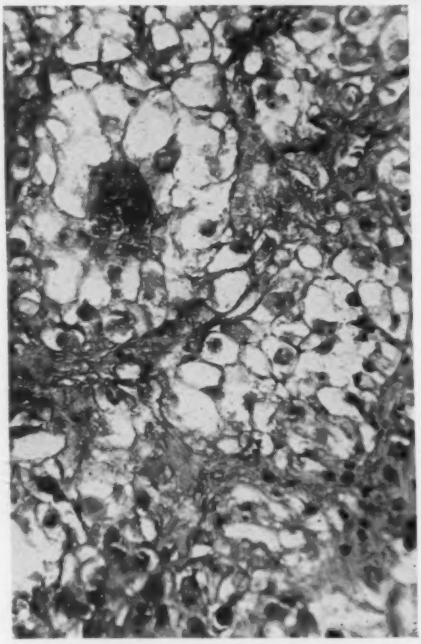

Fig. 3. High power. Same as Fig. 2.

field. The duration of treatments (number of days) depends upon the dimension of the lesion, a small area requiring from 15 to 20 days, the medium area from 20 to 30 days, and the large area from 30 to 40 days. In treating a deep seated carcinoma, several portals may be treated, which totals a depth dosage of approximately 10,000r, *i.e.*, ten times the amount which could be given by other methods. The reaction of the skin to such a dose results in an epidermis sicca, a condition

*International Roentgen unit.

in which the epidermis is completely exfoliated and the corium exposed. At the end of 14 days the epidermis has gone through a period of repair. There have been no injuries or inflammatory conditions of the skin recorded from the use of this method. The protraction of the single dose to diminish skin injury is accomplished by increased filtration from 0.5 to 2 c.cm., and the increasing of the distance from 40 to 60 and 80 cm. The time of each treatment is consequently increased 30 minutes to from two to four hours.

Fig. 4. After radiation, showing complete disappearance of metastatic right tonsil extending to the uvula.

The reaction in irradiating the oral cavity is noted by a pseudodiphtheroid membrane which develops on the mucosa and the presence of a dermatitis which disappears in two to three weeks. The less severe earlier reactions are dryness of the mucous membrane of the mouth and pharynx, a disturbance or complete loss of taste, and dysphagia. These local complications are reduced and later complications are practically avoided by an accurate technique, carefully measured and divided dosage.

Records of a four-year period show that 28 per cent of the cases of carcinoma of the larynx, formerly considered incurable, have been cured by the Coutard method. In cases treated only by surgery, a cure of 6.6 per cent was obtained. Twenty-six per cent of the cases of carcinoma of the tonsil were cured by Coutard irradiation. Similar results were obtained in inoperable cases of carcinoma of the oral cavity, pharynx and larynx.

The Coutard technique, or prolonged fractional dose method, causes no serious changes in the deep seated organs, while injuries will occur by the administration of the single dose method. For tumors of the cheek, larynx and tonsils, the Coutard method is the generally accepted technique and we find the results in these cases, as well as in other cases where the above described technique is indicated, equal in proportion to the percentage of cures as reported by Coutard.

202 Weirfield Street, Brooklyn.

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THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

April 18, 1934.

Roentgenologic Interpretation of Cysts and Tumors of the Upper Jaw. Dr. S. Fineman, New York.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. PAUL KLEMPERER: I can hardly say anything that will express my great indebtedness to Dr. Fineman for having shown this very beautiful and most illuminating series of cases. I really think there is hardly anything missing in the series he has shown. In regard to the pathology, I do not think it would be right to go into finer details.

I would like to ask Dr. Fineman a question, as to whether he has seen in his extensive experience any cases of lipoid granulomatosis, better known as Schueller Christian Disease, which deserves attention because of the early symptoms which occasionally occur in the region of the maxilla. The teeth become loosened and this is an early symptom of the disease. We have seen one case which extensively infiltrated the antrum on the right side, and with extensive involvement of all the bones.

Cases of malignant mixed tumors are very interesting, particularly if they are located in the palate; this location is not so uncommon, and in such an instance it might involve the antrum also. We have seen only recently one of these tumors which infiltrated the base of the skull. The adamantinoma presents a most intricate histological problem and is not so characteristic from the macroscopic viewpoint. The difficulty presented to the Roentgenologist is to distinguish from the gross picture the histological nature of the tumor. This, of course, is a most difficult problem, and I can realize the difficulties which the Roentgenologist encounters in this respect. I think in the long run the pathologist will have to decide upon the nature of the tumor.

DR. S. FINEMAN: I have not seen any cases of lipoid granulomatosis in this series. In regard to adamantinoma, I should like to add one point. They are of additional interest to the rhinologist because they occur at the base of the skull. They are of ectodermal origin and are said to arise from buccal epithelial rests. There have also been reported to date four cases of adamantinoma of the tibia. One case has been described in the lung. It is difficult to explain the development of tumors of dentigerous origin in such locations.

In conclusion, I wish again to stress the point that the Roentgenologist cannot always differentiate all of the cysts and tumors that occur in the upper jaw. He can, however, be of considerable assistance to the clinician in the study and interpretation of these cases.

Presentation of Patients with Laryngeal Carcinoma Treated by Roentgen Rays (Six Cases). Dr. I. Seth Hirsch, New York.

Almost exactly a year ago, Dr. Baum and I were privileged to present to you a paper in which we discussed the use of the X-rays in treatment of laryngeal neoplasms. It occurred to me that it might be of interest at this time, after the lapse of one year, to report on the progress of the cases treated, and to present for your scrutiny the six patients, who, at that time,

showed no evidence of the disease after the treatment. One year ago, of the 13 cases treated, the treatment had entirely failed in five, in spite of a primary disappearance of the lesion in all the cases. There were two patients who were alive but not symptom-free; these have died. The six who, one year ago, were clinically well without any evidence of recurrence, are still in that fortunate condition; they are here tonight.

Three of these cases had intrinsic, three, extrinsic lesions. The growths shown by biopsy study were squamous cell tumors with varying degrees of hornification and anaplasia. Actual treatment extended over a period of three to four weeks and the larynx received a surface dosage of about 8,000 R.

H. Z., age 48 years. Intrinsic cord rt. X-ray treatment, 2/12-3/13/31. Dose, 8620 R/ 31 d. Well, 37 mo. Weight, 161-186 lbs.

J. P., age 67 years. Intrinsic cord rt. X-ray treatment, 3/9-4/1/31. Dose, 6700 R/ 23 d. Well, 36 mo. Weight, 151-154 lbs.

A. S., age 35 years. Extrinsic. X-ray treatment, 8/4-8/26/31. Dose, 5000 R/ 23 d. Well, 31 mo. Weight, 170-210 lbs.

M. M., age 58 years. Intrinsic band rt. X-ray treatment, 8/11-10/24/31. Dose, 10,000 R/ 45 d. Well, 28 mo. Weight, 138-177 lbs.

B. B., age 65 years. Extrinsic. X-ray treatment, 10/3-12/29/31. Dose, 8400 R/ 27 d. Well, 27 mo. Weight, 137-161 lbs.

F. F., age 60 years. Extrinsic. X-ray treatment, 11/29-12/24/32. Dose, 8060 R/ 27 d. Well, 15 mo. Weight, 146-180 lbs.

In other words, five have been well over two years and two have been well over three years.

The question arises, is it possible as yet to express any opinion as to the best therapeutic procedure in cases of laryngeal neoplasms?

The surgical viewpoint seems to be, that since there is no way of foretelling the results of irradiation, surgical intervention comes first, and that irradiation is indicated: (1) in nonoperable cases; (2) when there is doubt that total laryngectomy has removed all the tumor; (3) if there is definite recurrence.

From our own experience, based on our failures and successes, and on analysis of the reports of others, here and abroad, I take the liberty of expressing the radiological viewpoint.

Statistics seem to prove that in certain types of intrinsic and extrinsic cancer, irradiation gives as good results as surgery. The radiologist should therefore have: (1) the intrinsic radiosensitive lesions; (2) the inoperable cases; (3) the cases in which there is doubt that the surgical treatment can effect complete removal. (Preoperative radiation may make the tumor operable and postoperative irradiation may make the results doubly sure.) (4) The cases in which there is definite recurrence after operation. (Irradiation is the only means at our disposal for this group.)

DISCUSSION.

Dr. Ira Kaplan: Mr. Chairman and members of the Section: It is very interesting to look back over the figures for cancer therapy during the past ten years, as we have had an opportunity to do at Bellevue Hospital and at the Cancer Hospital in the City of New York. In most instances during the past eight years, cancer of the larynx has always been considered primarily as a surgical condition. The radiation therapist has been called in only as a palliative messenger to speed the patient on to a rapid death. We accepted that method of treatment in the early days because we had nothing else to offer,

and yet I can remember back in the years gone by that there were occasionally some cases that did respond to irradiation. As we understand it today these cases responded because the type of tumor that we did not recognize so well then is that type which we recognize now as the radio-sensitive type. However, it is still a very hard job to get the laryngologist to agree that some cases are essentially fitted only for irradiation. My good friend Dr. Hirsch hesitated a bit in saying that these cases should be definitely treated by irradiation. He thinks that they should be associated with surgery in some manner or other. Since Coutard has worked out this new plan of radiating these lesions and has made such a success, we believe that there are certain types of carcinomas of the larynx that are best treated by irradiation and that no surgical procedure should be attempted whatsoever. We have had under our jurisdiction in the past ten years, 213 cases of cancer of the larynx, of which we have a definite record of only 21 being alive in that period of time.

The Coutard method, of course, is not the only method for radiating cancer of the larynx, but we feel that it is one of the most advantageous. The large quantity radium pack may give good results too. We have found, however, from experimentation that a small pack over a long period of time will give excellent results. I happen to feel like mentioning that technique to you just now because as a matter of fact we have received within the past three years at our custodial hospital 48 cases that have been treated with the so-called modernized radiation therapy. Every one of those 48 cases has been horribly technically mistreated, and we feel that these cases that Dr. Hirsch has shown you are really good examples of what should be done for effective treatment in safety as far as the patient is concerned. Other methods that have been modified or that have been used without clearly understanding the necessity of knowing just what should be used and how to use it in the cancer cases has always led to destruction of the patient more or less rapidly. It is very essential that if radiation is to be used, it should be properly employed in the case in question only by one trained and experienced in this work. Any other method leads to destruction.

Dr. Hirsch has shown some very interesting cases, but it is a good point to bring up, too, that the older your patient with this type of lesion the more satisfactory the result will be with irradiation. One cannot be so hopeful in the younger people. I have examples of all types. Dr. Imperatori did a very beautiful laryngectomy on one of our cases that we have at present at the Island for institutional care, in a young person with absolutely no evidence of recurrence. However, the usual young man or young woman who has had a laryngectomy performed will show an early recurrence, and the usual case that has been treated by irradiation will likewise show a much shorter period of regression than the older people. So it may be well to bear in mind when you prognosticate the reaction of the malignancy in these cases that you should hold back your enthusiasm when treating patients in the younger age group and that you can offer a much better hope in the older patients than in the younger.

This method of treatment requires special observation and care. It cannot be done in a short period of time. It requires many days, a month and sometimes more. It means a severe attack on the patient, both in his general and local condition. He requires care over a long period of time, not ordinary, cursory care, but specialized care. These patients find a great deal of difficulty in carrying out the normal acts of living and all these things have to be taken into consideration when treating them. I think that whenever you can produce even one or two cases of cure of cancer of the larynx, as Dr. Hirsch has shown you here tonight, that the therapist should be congratulated for his successful outcome.

DR. MAURICE LENZ: Dr. Hirsch's cases illustrate the debt which radiotherapists owe to Coutard for his now famous treatment. Such beautiful results could not have been obtained by the use of the old type of X-ray therapy.

There are several points, however, which I would like to emphasize. During the period of X-ray reaction and the formation of the pseudo-diphtheritic membrane in the irradiated larynx and pharynx, swallowing is painful and dehydration is apt to occur if the patient's fluid intake is not watched. Aspiration bronchopneumonia may result at this time and the patient die, though the cancer may have been arrested. Squamous cell carcinoma invading cartilage cannot be arrested by X-ray therapy alone. I have not been able to control epitheliomas invading the epiglottis, in contradistinction to those which were limited to its mucosa. The resistance of the thyroid cartilage to irradiation is lowered in the aged, or wherever there is interference with the circulation, as illustrated in the following instances: In one case, a man of 80, whose cartilage radiographically appeared ossified, there was a radionecrosis a year after treatment; (2) in a man of 50, who had a preceding hemilaryngectomy, the same occurred immediately after cessation of treatment; and in a third patient, who had a sebaceous cyst attached to the cricothyroid membrane, which broke down during the primary X-ray reaction, the thyroid cartilage necrosed five months after treatment.

Zuppinger reports two late necroses of the thyroid cartilage where tracheotomies were done in the irradiated field. He advises to place them as low in the neck as possible, outside of the irradiated field, and if indicated, to do them before beginning X-ray therapy.

We have not been able to arrest differentiated epitheliomas arising from the true cord when the cord was fixed, in contradistinction to small, undifferentiated epitheliomas of the true cords where the cord was movable. We believe that X-ray therapy in the former should be used only postoperatively after laryngectomy or the complete submucous removal of the cartilage, as done by Hautant.

All other epitheliomas of the larynx, i.e., those arising from the epiglottis down to the cords, we treat with X-ray, unless the microscopic picture is that of a definitely radioresistant tumor.

We have not used preoperative radiotherapy.

I congratulate Doctor Hirsch, not only upon the beautiful results obtained, but also on the way the skin looks today. The skin of a few of my earliest cases does not look as well.

Cancer of the Larynx; Some Conclusions Derived From Personal Experience. Dr. Joseph C. Beck, Chicago.

Mr. Chairman, ladies and gentlemen: It is indeed a great pleasure for me to come again before this Academy. I do not know just how many years ago it was when I came here before, but it is a great pleasure and I want to thank you, Mr. Chairman, for inviting me and my associate to present our experience in this disease, cancer of the larynx.

The first thing that I want to say is to express my appreciation of a great teacher whom we have lost, one of your New York men, a great man in this work. I regret his loss very much and I would be very much happier if he were sitting here to hear me say the things I am going to say about cancer of the larynx. I speak of Dr. John MacKenty. It was due to his efforts in improving the surgical technique more than anything else that has had to do with my more hopeful attitude toward this condition of cancer of the larynx, and also to the progress that has been made along the lines of diagnosis, particularly the pathological diagnosis, the diagnosis regarding the minutia as to the type of tumor we mean when we say cancer of the larynx. The classification of these cancers is a very important factor.

The paper will be read by Dr. Guttman. I would ask your indulgence in looking at what I might call the historical portion of my work in a number of years, presenting a series of cases that came under my care before I learned

what I did from MacKenty. I am not going to describe any of these cases. I call this film, "Love's Labor Lost." It shows that the work that has been done is practically useless. There are a few cases shown there that have been benefited. It will show very well what one speaker, a radiologist, brought out in the previous discussion, as to what methods and knowledge we had and what we now have or rather hope to have, for we certainly have not yet reached the point where we can say we have cured cancer of the larynx. Cure is a relative term when it comes to cancer anywhere of the body.

(Demonstration of films.)

These pictures are a record made of cases of all types of lesions. In former times we were doing mostly laryngofissures with so-called deep X-ray therapy, not what is known now as X-ray treatment. You can see in the film that the first view you get of them shows they are almost all of the extrinsic type. In other words, they show what we now see as a late diagnosis. The next series of views shows laryngectomies which were successfully done. The patients recovered from the operation, but recurrences invariably followed and death resulted. Many of them had what was supposed to be proper treatment with X-rays or even radium, but we know now that we did not have the proper technique. There is this one man I want to show especially because he is still alive now seventeen years after laryngectomy. He was an inoperable case of cancer of the larynx, that is to say, what you would call the extrinsic inoperable type. This man had two attacks of face and neck erysipelas following operation. He had no radiation, either before or after operation.

Now, ladies and gentlemen, if we were to have gone on in that way of treatment of cancer of the larynx as shown by these illustrations, it certainly would have been a sad spectacle. We will now turn on the present situation. We will present our paper on our experiences with cancer of the larynx, say since MacKenty's time. The paper will be read by Dr. Guttman.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. CAESAR HIRSCH: Mr. Chairman, Dr. Beck and ladies and gentlemen: Permit me to express my sincere thanks to your Chairman for the honor bestowed on me in the invitation to open the discussion of Dr. Beck's and Dr. Guttman's most significant lecture. I appreciate this honor the more, as the reputation of our distinguished speaker, which has spread far beyond the limits of this country, has been known to me for many years.

It is very difficult for me to say anything because I am in complete agreement with the lecture we have just heard. As you know, surgical therapy of malignancies of the larynx, like other surgical activities, has advanced to an unprecedented degree in the last decades. Skilled surgeons have had great successes. I had the privilege to watch excellent surgeons working in our field right in this country, and we had the pleasure just now to listen to a discourse by such outstanding surgeons. But if surgery of malignant tumors in the upper air passages seems to have reached an impasse, it is due to the difficulties of our special branch.

Treatment of these tumors by means of irradiation was, therefore, hailed with great hope. The deficiencies in the earlier period are doubtlessly more than outbalanced by the successes of recent times. To the question, "irradiation or scalpel," a physician's only consideration shall be the welfare of his patient. If we are able to eliminate with one operation the whole root of the disease without mutilating the patient too much, the decision would not be too difficult. But if the removal of a malignant tumor by means of surgery can only be effected by mutilating the patient so that the joy of living is taken from him, and if the carrying on of his work is impaired, then we have to ask ourselves, if we could not have accomplished the same or even better results, if we had used ray treatment without mutilating the patient.

In the short time allowed me, it is unfortunately not possible to go into comparative statistics on the subject of surgical and irradiation therapies. But in brief I want to say:

The curative results of laryngofissure can hardly be excelled by those of irradiation therapy; the functional results of radium application through a window resection of the thyroid cartilage, however, often exceed those of laryngofissure, as we are spared the necessity of opening the larynx and frequently also succeed in restoring a perfectly normal voice. In several cases we were able to remove small tumors on the motile vocal cord in suspension laryngoscopy with electrocoagulation, sometimes following it up with very careful irradiation treatment after Coutard's method. A few years ago I myself devised a set of instruments for electrocoagulation in our field.

Perhaps we may hope that some time in the future, cases calling for laryngectomy may be cured by X-ray or radium therapy. Even the most favorable statistics of laryngectomy do not show more than 30 per cent of lasting cures. Coutard's and others' results give us hope, however, that by resorting to protracted fractional dosage with X-rays or radium bomb (4-5 gm.) we may reach better success in the future. This method is still too young for us to form a definite opinion on lasting results.

A further perfection of irradiation therapy may perhaps be found in the combination of interstitial application of radium into the growth after a window resection of the thyroid cartilage, and the protracted fractional dosage with X-rays or radium bomb; the former to fight the primary tumor, the latter to prevent the spread into the surrounding regions and the lymphatic system. We must not forget that laryngectomy can look back on a long history of development—a history of more than 60 years. Compared to it irradiation therapy is a very young science and probably carries many secrets which mankind has not yet been able to discover. We must, therefore, anticipate reverses in irradiation therapy just as we experienced them in the protracted fractional doses with X-rays or in the radium application through a window resection of the thyroid cartilage in the form of necrosis of the cartilage or in the form of abscesses.

Dr. Guttman told us that Morell Mackenzie once said: "The only possible termination in cancer of the larynx is death." But since Dr. Beck and Dr. Guttman could tell us tonight that they have succeeded in lastingly curing 80 per cent (Gluck and Sorrensen mention even 94 per cent) of cases of intrinsic cancer, suitable for laryngofissure, and in 51 per cent of intrinsic cancer suitable for laryngectomy, we may hope that perhaps the time will come when laryngologists shall be in a position to treat still more cases of intrinsic cancer with laryngofissure and the remaining intrinsic and extrinsic cancers may be cured without mutilating operations. But we can hope for these much to be desired results only if both experienced laryngologists and ray-therapists join forces in the battle against malignancies of the larynx.

DR. CHARLES J. IMPERATORI: Mr. Chairman, ladies and gentlemen: I feel highly honored in being asked to continue this discussion of the paper of Doctors Beck and Guttman. I am delighted to know that they are stressing this "hoarseness-conscious" campaign in Chicago, and also to hear of this new method that they have developed in voice production through a fistula in the hypopharynx. We have had patients with exactly the same story that Dr. Guttman delineated relative to the use of the Mackenty artificial larynx. These people apparently were of high intelligence, but they simply could not adapt themselves to the use of this instrument. Other patients of lesser degree of mentality seem to adapt themselves promptly to the use of the buccoesophageal voice and frequently have done so within a month after laryngectomy.

The first laryngectomy that I did, some 15 years ago, was a two-stage one and following the second stage there was extensive inflammation and cellulitis of the neck. The patient still survives. There are several patients on whom

thyrotomies were done 17 and 18 years ago and they remain without any recurrence. There are many other laryngectomies that I have done, none of whom are alive after four years.

It is possible, when one analyzes his experience, that it might have been a better plan to have combined surgery with irradiation, and although my experience with irradiation is not good, I still feel that there are great possibilities in combining the two methods. There is one case on whom a biopsy was done, and immediately following the operation, the implantation of radium needles. This patient is alive after 12 years. It may be possible that the biopsy removed all the cancerous material.

There is more or less of a controversy regarding classification and what makes up an extrinsic growth. If one operates on extrinsic growths that extend into the pharynx or esophagus, the chances are, regardless of what operation is done, whether it is the Trotter operation or the modification of it of Dr. Orton, I am reasonably certain that unless irradiation is employed, there certainly will be recurrences. Of course, we do not operate on patients who have any adenopathy.

I again want to stress the point that we will try, in New York, to make our patients "hoarseness-conscious," and I feel that this is one of the important considerations that Dr. Guttman has presented to us this evening. We have, here in New York, a society patterned somewhat after the idea of the Society for the Hard-of-Hearing, for those who have lost their voice either through laryngectomy or any other condition. The most important teacher connected with this society is one who was operated on some eight or ten years ago by Mackenty. He instructs all who come to the society, that meets twice a month, and gives them great encouragement and great mental ease. He has taught himself to speak so well with his buccal voice that it requires a trained ear to recognize it as a buccal voice. Probably you will found such a society in Chicago.

DR. DUNCAN MACPHERSON: Mr. Chairman, Dr. Beck, ladies and gentlemen: It is always a pleasure to listen to Dr. Beck at any meeting. He always has something to give us. This paper tonight, I agree with Dr. Hirsch, is difficult for me to discuss because I agree with practically everything that was said in it.

I would like to emphasize the difficulty of deciding the methods of handling cases of the extrinsic type, the anatomically extrinsic cases. A few years ago, Dr. Buckley brought to my attention the central incision for laryngectomy in cases where the pharynx was involved, removing the hyoid bone at the time of operation. A vertical and not a T incision was used. It gives a good view. It gives a good approach to the pharynx and allows one to remove pharyngeal tissue on both sides. I have done it in two cases, and the method of approach, the opening and the opportunity to remove the pharyngeal tissue by diathermy was very easily done and apparently quite complete also. In two cases of mine where the pharyngeal attachments were removed by diathermy, feeling that the irregularity of the edges and small amount of pharyngeal tissue left would, in all probability, melt away, I left the wound open except at the lower angle where support was given to the trachea. The postoperative wound was accessible, suction and treatment could be applied, granulating areas taken care of and I am sure a better result obtained than would have been the case had I closed the wound in the neck and depended on cleaning through the mouth or drainage tubes. Much of the good result obtained is due to competently trained nurses and natural nursing instinct.

Another point in these cases that was brought out in the paper was the fact that the glands of the neck were frequently not involved in extrinsic cases. There were no palpable glands in the neck in the cases referred to above, even though the pharynx was involved in the carcinoma. Another point I would like to emphasize is the fact that it is impossible before operation very frequently to say whether the pharynx is involved in the carcinomatous disease

or not. Infiltration external to the larynx will be present and if you will take a section you may or may not be fortunate enough to get the involved tissue or carcinomatous tissue. I was struck with that in one case where a marked edema of the tissues posterior to the larynx was present, including the aryepiglottic fold and the glossoepiglottic folds, and in which I took out a large part of the pharynx by diathermy. Under the microscope, there was no carcinomatous tissue evident in the pharyngeal tissue. Now, what should a person do in a case of that kind? You cannot disprove that there is carcinoma in that tissue before operation, because if you do go in and take out a piece, you may very easily miss the involved area. That is shown in cases where frozen sections are made in carcinoma of the breast. Frozen sections are never satisfactory unless the total tumor can be examined, which cannot be done from a section because you may miss the malignant area.

So far as mutilation is concerned, of course laryngectomy is mutilating, and if there is any other way to get rid of these malignancies, it should be resorted to. However, I do not think that a man going around without a voice is as bad off as one who is blind. Yet, no one hesitates to take out one eye or a good eye if the other is blind if it is necessary to save a life from malignancy of the orbit. The same thing is true of carcinoma of the larynx. The matter of hoarseness is very important. I do not know if we can ever educate our people to be sufficiently hoarseness-conscious, as Dr. Guttman suggested, to make it a practical point. I do think we can probably educate some of our doctors to the importance of it. As for the general practitioner, we must not expect too much of him. He cannot very well make a good examination of the larynx. He cannot tell whether the motility of the larynx is equal on the two sides, or whether there is any inequality of the contours on the two sides. It is hard enough to see the anterior commissure and see it thoroughly for those who are handling these cases all the time.

One must not overlook the fact that the microscope, too, is not always telling the truth. It does make a mistake in differentiating between syphilis, tuberculosis and malignancy. That statement of mine has been questioned, but I know that it happens. I have seen it happen. So it is very important that more than one pathologist should examine the slide where either the microscopist or the microscope may be misleading. Also, if there is any question of doubt there should be a therapeutic test made for syphilis in addition to the Wassermann because its presence would make a difference in regard to operative risk and it is important in regard to postoperative healing.

I want to thank you, Mr. Chairman, for giving me the opportunity of discussing Dr. Beck's paper.

DR. ROBERT E. BUCKLEY: Mr. Chairman, Dr. Beck and gentlemen: As the other doctors said, it certainly is a privilege and an honor to be asked to discuss the paper by Dr. Beck and Dr. Guttman. I have so little to say because I, too, agree with everything that has been said. In regard to the laryngofissure, it is lamentable the number of cases that we see in which it can possibly be done. Certainly here in New York, in a very large number of cases, to get a case in which a laryngofissure would be indicated is tremendously rare. I do not know why it is. Concerning Lewis' statistics in London, it is possibly because the concentration of population in England is so very different than here, that their doctors and the whole population can get together better, or maybe it is because our race is more cosmopolitan than theirs. Anyway, we see very few here that I think are susceptible to laryngofissure.

I think Dr. Beck is to be congratulated on his statistics, both from the practical standpoint of his results and for the keenness with which his statistics were kept on a scientific basis.

I have noticed a peculiar thing and I wondered if Dr. Beck or Dr. Guttman have happened to notice it, that is, in doing laryngectomies we used to run a great deal of sugar afterward. At that time we were ligating the isthmus

and probably got a little necrosis of the isthmus of the thyroid because in the ligation there was an eighth of an inch of the thyroid isthmus left which would probably necrose off. Recently in a number of cases instead of doing that we have been pushing down the isthmus of the thyroid, thereby getting away without ligation, and we have not had any increase in sugar since then. I do not know if there is anything in it or not.

About the artificial voice box, it is interesting to see that the New York Telephone Company are perfecting and think they will have perfected soon a small artificial voice box which it will not be necessary to connect in any way with the trachea. It consists of a series of dry cells which are held in the hand and a tube which goes into the mouth. There is no connection with the trachea. This will be ready in a month or so, I think, and I shall be happy to send you one, Dr. Beck.

I think the question of X-ray and surgery is coming to a more sensible standpoint. I do not think we can ever let our feet get off the ground and get too wild about the X-ray until we are quite sure of it. In other words, in the surface tumors in which the laryngofissure has proved to be an excellent operation, it is very questionable whether that type, to my mind, should be allowed to take a gamble on the X-ray. I think that case should have a laryngofissure. It seems as if the higher the malignancy, taking the Broder classification, the softer the part of the larynx in which the growth will appear, and the more benign it is, the harder the part of the larynx in which it will appear. For instance, the I and II are more prone to occur on the cord, and the III and IV are more prone to occur in the soft parts of the larynx. That again makes me think that surface growths would be more prone to be radio-resistant and consequently the laryngofissure operation would seem to be all the more indicated in the majority of those cases.

I do not think I have anything else to add, except that in a series of cases here we have been trying radical surgery plus the removal of the glands, and then submitting them to radiotherapy. We have nothing to report on in these cases because the time is still too short.

Dr. Henry B. Orton: I wish to express my thanks to Dr. Beck for such a delightful presentation. We always learn something from Dr. Beck. In extrinsic cancer of the laryngopharynx, to know the results of the Coutard method is an important factor. But so far, even with the favorable results, sufficient time has not elapsed to give definite results.

Dr. Paul Klemperer: Mr. Chairman, I should like to make a confession. Whenever I receive a biopsy from the larynx for diagnosis, I have a slight attack, sometimes even more, of heart palpitation, because I do not know of anything more difficult and more responsible than the diagnosis of laryngeal biopsies for carcinoma. This concerns not so much the difficulty in reaching a diagnosis with regard to cell type or in regard to the classification and grading of the tumor, but the fact that a small biopsy may not show carcinoma while the vicinity may contain it. We have made it more or less of a rule, therefore, to examine every specimen in serial sections in order to be sure that every bit of tissue submitted has been examined. Another point is that whenever a biopsy is submitted for diagnosis, I receive not only the specimen, but I receive the exact orientations, the exact information as to how the specimen was taken out. In fact, most of my colleagues submit the material personally in order that I may be able to place it in the proper way for study. I think it is a very important point in reaching a correct diagnosis. Nevertheless, there are undoubtedly cases in which one misses the carcinoma or in which one may not realize that a lesion is a precursor of later developing carcinoma. Such cases occur; I have seen them and have failed in making a diagnosis.

There is one point which Dr. Macpherson emphasized. It is sometimes difficult to differentiate between epithelial proliferation in syphilis, tuberculosis and carcinoma. Tuberculosis may sometimes produce most extensive prolifera-

tion which simulates carcinoma. That was impressed upon me from my days as an assistant, when I was warned not to make a diagnosis of carcinoma unless I could see definite infiltration. Epithelial proliferation alone does not mean carcinoma, as you have seen from Dr. Kleinfeld's presentation here tonight.

DR. JOHN M. LORE: Dr. Beck's paper made reference to keratoses or hyperkeratotic papilloma. As I mentioned here last month, we had four cases, one of which we followed to his death in which definite malignancy developed. This man had refused operation. In the other cases we were able to demonstrate some malignacy. The question arose as to the management of these cases where you have a bilateral lesion of the larynx, whether to do a bilateral laryngofissure or use some other type of treatment. In the thesis I presented at the meeting in Atlantic City, based on work done on 40 cadavers, supplemented by operations on humans in five cases, I advocated to so place your incision as to get a better exposure of the interior of the larynx, and further advocated a V-shaped incision of the thyrohyoid membrane, spreading the larynx wide open and looking inside. The importance of that is that we occasionally get cases who absolutely refuse to submit to laryngectomy, but who will submit to a laryngofissure. We had one case like that 18 months ago in which we had recommended laryngectomy. In that case we were able to carry the dissection down to the cricoid. It is possible with better exposure that we might be able to extend the scope of our laryngofissure cases, not only to those cases in which the cord is movable. In these grades I and II that Dr. Buckley mentioned, if they are not very extensive even with a certain degree of fixation, one might possibly attempt a laryngofissure with good exposure of the larynx.

(To be continued in a succeeding issue.)

RESOLUTIONS ADOPTED BY AMERICAN RADIUM SOCIETY AT ANNUAL MEETING, CLEVELAND, JUNE 12, 1934; ALSO ADOPTED BY AMERICAN COLLEGE OF RADIOLOGY, JUNE 12, 1934.

THE INDISCRIMINATE USE AND RENTAL OF RADIUM.

WHEREAS, It is now recognized that radium has been demonstrated to be of definite value in the treatment of disease, and

WHEREAS, Some States and many communities in the country have little or no radium available, and

WHEREAS, Funds are not always available for the purchase of suitable preparations of radium for use by those physicians who are qualified in radium therapy, and

WHEREAS, We recognize that radium is an agent quite as potent for doing harm as for doing good when used without sufficient skill or training and with the hope of protecting the uninformed public from serious and irreparable injury from improper and insufficient treatment.

BE IT RESOLVED, That we consider it improper, unethical and detrimental to the science of radiology and to the good of suffering humanity for commercial laboratories to attempt to give advice or directions as to the use of radium in the case of a patient whom the person giving that advice has not even had the opportunity to examine. In other words, it is just as difficult to give such advice and directions as it would be for a surgeon to give directions for the use of rented surgical instruments so that an untrained physician might attempt an operation. Various commercial companies advertise both in the journals and through the mails, medical advice for the purpose of making sales or renting radium or radon. This places these corporations in the field of practicing medicine.

BE IT RESOLVED, That the same criticism be applied to institutions which rent or furnish their radium to those members of their staff or outside of the staff who are unskilled in radium application.

RESOLVED, That the same criticism applies to many individual owners of radium.

RESOLVED, That we regard the approval of the National Board of Radiological Examiners as the minimum standard for those assuming the responsibility for using radium. We recommend as wide publicity of this Board's existence and approval as is possible to the public, consistent with ethical practices, as the most effective safeguard which can be afforded them.

RESOLVED, That we recommend the refusal of advertising matter in national and state journals when the companies concerned are advertising a medical consulting service or are advertising such service through the mails in connection with their sale or rental of radium.

RESOLVED, That we disapprove of any doctor's acting as a consultant to a commercial company carrying on such a campaign of public or private advertising and that we consider such an association sufficient grounds to warrant disbarment from the approval of the National Board of Radiological Examiners.

RESOLVED, That we recognize the ethical commercial company as a necessity. It is the advertised consulting service that is at fault. It is recognized that such restrictions on the advertising of a medical service will in no way hamper properly qualified radium therapists in obtaining adequate supplies of radium or radon for the purposes in which they are qualified to use it.

RESOLVED, That we approve an informal medical consultant for the guidance of those commercial companies who refrain from advertising such professional service, either publicly or privately, and that in such case their informal consultant be one approved by the National Board of Radiological Examiners.

Resolution:

The following resolution was presented by the Executive Committee and adopted unanimously by the American Radium Society, Cleveland Session, June 12, 1934.

WHEREAS, It has been proven that radium and X-rays, when used properly, and in sufficient quantity, is efficient in the treatment of cancer in certain locations, and

WHEREAS, There is a general fear in the public mind from X-rays or radium burns, which because of this fear, prevents competent radiologists from using sufficient radium or X-ray to produce the best results.

BE IT RESOLVED, That we as radiologists recognize that in the treatment of malignant disease, it is often necessary to carry the treatment on to the extent of producing a violent reaction in the surrounding tissues, which may cause the skin to peel, and blisters to form, in order to give sufficient treatment to overcome the malignant disease. We believe, therefore, that it is justifiable to produce a second degree radiodermatitis when necessary.